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LONDON CHAPTER OAS

February, March & April 2013 13-2, 3 & 4

The March meeting of the London Chapter OAS will be held on Thursday, March 13, 2014 at the Museum of Ontario Archaeology. The speaker will be Dr. Peter Timmins of Timmins-Martelle Heritage Consultants and the University of Western Ontario, who will speak about recent archaeological research in West Elgin County in a talk entitled: ***Living on the Edge: Two Early Late Woodland Components on the Iroquoian-Western Basin Borderland***.

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The April meeting of the London Chapter OAS will be held on Thursday, April 10, 2014 at the Museum of Ontario Archaeology. The speaker will be Dr. Christopher Watts, who will speak about his recent archaeological research at the enigmatic Cedar Creek Earthworks near Lake Erie.

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Speaker's Night is held the 2nd Thursday of each month (January to April and September to December) at the Museum of Ontario Archaeology, 1600 Attawandaron Road, near the corner of Wonderland & Fanshawe Park Road, in the northwest part of the city. The meeting starts at 8:00 pm. Doors open at 7:30 PM and as usual there will be free juice and cookies!

Chapter Executive

President
Nancy Van Sas
nancy.vansas@gmail.com

Vice-President
Darcy Fallon
32 Pleasant Ave., Delaware ON N0L 1E0

Treasurer
Jim Kerron
Jkerron5461@rogers.com

Directors
Darryl Dan (darryl.dann@sympatico.ca)
Christopher Ellis
Christopher Watts

Editors
Christopher Ellis (519-858-9852)
cjellis@uwo.ca
Christine Dodd (519-434-8853)
drpoulton@rogers.com
Christopher Watts
christopher.watts@utoronto.ca

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Hi-Lo Point Life Histories

by Chris Ellis and D. Brian Deller

INTRODUCTION

This paper presents a detailed analysis of Hi-Lo points (Fitting 1963a, 1963b, 1975:42-43) with a focus on explaining variation within this point form. Hi-Lo points are common on sites in the lower Great Lakes area. Such points have been reported from Michigan (Fitting 1963b), Ontario (Deller 1976, 1979; Roberts 1980), northern Ohio (Griffin 1965:660; Payne 1982; Stothers and Abel 1992), northern Indiana (White 2005:5-6, 2006), eastern Wisconsin (Mason 1963:21) and although rare, in westernmost New York (Smith et al. 1998:8-10). They may also be present in Minnesota (Shay 1971:56) and northern to central Illinois (Evans and Womac 1998; Munson and Downs 1968:27) but the certainty of identification in these cases is unclear.

Elsewhere (Ellis and Deller 1982) we have presented evidence on these points as well as associated tools focusing on the age and the relationships of this material to lithic industries outside the lower Great Lakes area. Point attributes including a high incidence of edge beveling, shoulders and the application of certain probable functional modifications, in addition to associated tools such as gravers and “spokeshaves" (concave scrapers) on true blades and slight stemmed twist drills, were used to suggest that Hi-Lo could be conceived of as a lower Great Lakes area variant of Tuck's (1974) Dalton horizon, a proposal with which others seem to agree (e.g. Koldehoff and Loebel 2009; Koldehoff and Walthall 2009:138-139; Jennings 2010; White 2005:5-6, 2006:36, 2012:190, 2013). Indeed, White’s (2012:245, 259) study of Hi-Lo and Dalton distributions shows that while they occur in adjacent areas they are largely mutually exclusive in space with little overlap, a pattern suggesting contemporaneity. As such Hi-Lo can be regarded as Late Paleo-Indian or Early Archaic (or both/”transitional”) lithic industry (depending on the goals of one's classification) and should date to around 10,000 BP (DeJarnette et al. 1962; Ellis 2004a; Goodyear 1982; Wood and McMillan 1976). Ellis (2004a:64, 68) believes Hi-Lo is a direct development out of the older Holcombe complex or phase (see Fitting et al. 1966; Wahla and DeVisscher 1969) due to these tool kit similarities and the presence of certain point forms (Hi-Ho) that seem intermediate in form between Holcombe and Hi-Lo points. However, others believe Hi-Lo may represent a population replacement or developed from technologies found farther south such as Quad (e.g., White 2006:50, 2012:343). Deller also thinks Holcombe and Hi-Lo are quite different and so is not convinced there is continuity between the two.

In the present study, we focus solely on the Hi-Lo points and as noted above, particularly with regard to understanding variability within this category. Hi-Lo points are the most commonly encountered of the early point forms, probably because they were used for a wider range of tasks than earlier dating forms (see below) and also the fact seem to have been in use for an extended period of time or several hundred years. In fact, they are extremely variable compared to all other Paleoindian points and it is plausible this characteristic is due to the extended time of use with part of this variability measuring change over time. For example, those points generally referred to as Hi-Lo in the past include at least two widely recognized varieties based on variation in the morphology of haft areas: 1) “Classic” forms which have a distinct, although not pronounced, stem or juncture of the wider fore-section and narrower basal area; and 2), a shallowly but definitely side-notched variety (Ellis 2004a:63-64). Sometimes a third, and probably earlier dating, variety of thick, lanceolate unstemmed forms have been included in the Hi-Lo category (e.g. Ellis 2004:63) but most often that has been placed in a separate taxon from Hi-Lo called “Holcombe-like” (Ellis and Deller 1990: Fig. 2d) or as noted above, “Hi-Ho” (Deller and Ellis 2001:274; Timmermans 1999). Some regard Hi-

Ho's as intermediate in form between the Classic stemmed and presumed earlier Holcombe point forms. We exclude this third, Hi-Ho, variety from consideration in this paper.

In any case, while such temporal variability may exist within haft form, we ignore it for the purposes of this paper and instead focus of here on the examination of formal variability within Hi-Lo points in terms of: 1) the stages of manufacturing including blank selection and reduction and 2) changes in the morphology of finished points due to breakage in use, edge dulling and subsequent resharpening or reworking; that is we assume that there was no change in these aspects over the time these items were in use. These sources of variability have been referred to by Sheets (1975) as "technological analyses" and by Wheat (1975) as analyses of "artifact life histories". More recently the term "reduction thesis" has come into vogue (Shott 2005). However, we prefer to continue think of these factors as a whole as "ontogenetic effects" or that variation is affected by events in the "life history" of a tool. Therefore, we continue to employ Wheat's (1976) term "life history" as a more encompassing and more accurate assessment of what is being investigated than "technological analyses". As well, we believe "life history" is a term that has precedence as it was used first in the archaeological literature and is preferable as it applies to studies of any technology and not just to stone tools as is the case with the term "reduction thesis".

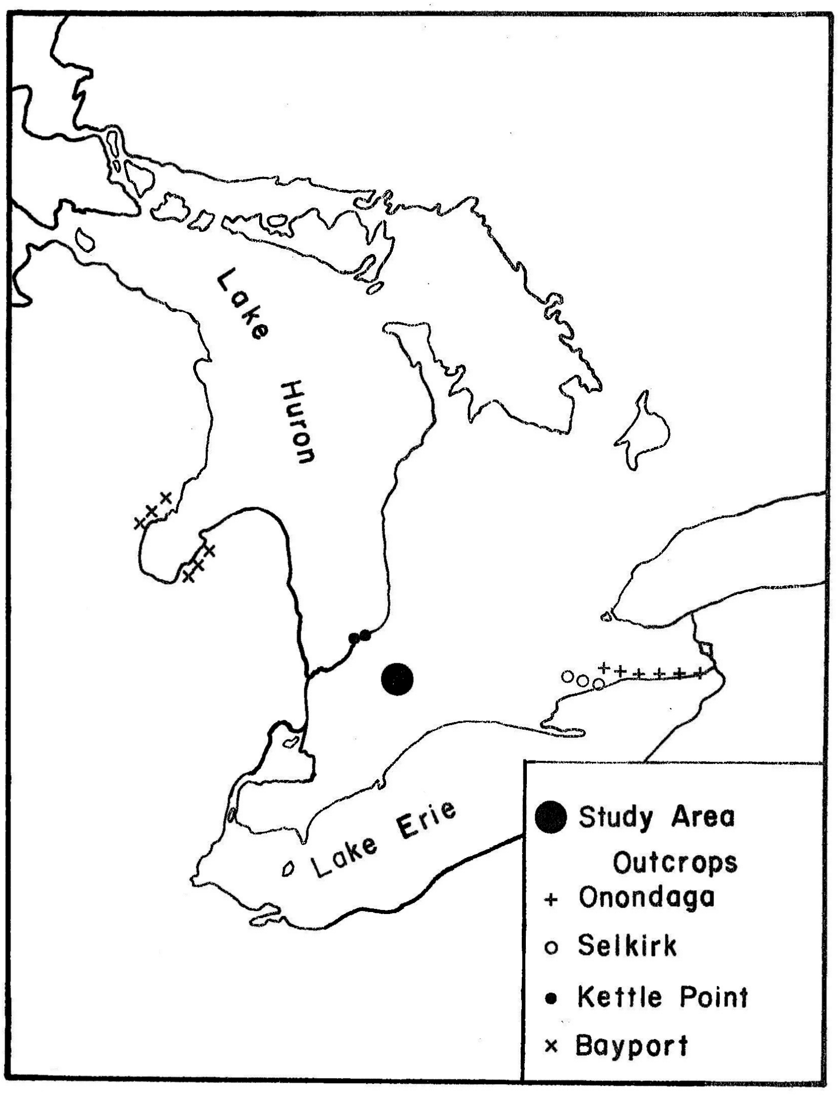

Figure 1: Location of Study Area and Chert Outcrops.

The advantages and usefulness of a life history approach to tool typology, especially as it pertains to cultural historical and "reconstructionist" (Dunnell 1978) goals in archaeology have been documented and discussed by several authors (i.e. Frison 1968; Frison et al 1976; Goodyear 1974; Jelinek 1976:22; Morse 1971; Peterson 1978; Schiffer 1976:44; Wheat 1975). Briefly, with regard to temporal or spatial significance (e.g., cultural historical significance), many named types have been assigned such significance only to have subsequent research show that such types are simply different stages of reworking or manufacture of the original artifact form (see, for example, Roosa 1965, 1968; Wheat 1975). Such has been the case for Hi-Lo where reworked point varieties have

been referred to as Greenbriar Dalton (Wright 1978:63,66) or, a common occurrence, as fluted points. We ourselves have been guilty of this latter error (i.e. Deller 1976:14, Plate 4, I.1). Also, there has been a tendency to regard what appear to be Hi-Lo preforms as finished points (i.e. Quimby 1960:36, Fig. 14, lower left; Shay 1971:56).

Part of this problem is due to the normative typological concepts employed in the original Hi-Lo point type description of Fitting (1963a) -- that description focused largely on invariant attribute states related to assessing the age of Hi-Lo points (such as basal and lateral grinding) rather than documenting attribute state (or variable) variation which could serve to distinguish Hi-Lo points from other early point forms. It is also as a result of this normative focus that: 1) the exact geographical distribution of Hi-Lo points is difficult to determine; and 2) that there has been a tendency to lump Hi-Lo points in with other point forms (some of which may not even be of a Paleo-Indian to Early Archaic affiliation) into more general categories such as “unfluted-fluted” (Prufer and Baby 1963:22) or even “Chesrow” (Overstreet 2003). Clearly, a "non-normative" approach emphasizing formal variability is an explicit component of a life history study.

To summarize, we would argue that a life history analysis is a necessary pre-requisite to the creation of types assigned temporal-spatial significance if the resulting typologies are to be of maximum utility in this regard.

Table 1: Hi-Lo Point Sample by Site.

Site/Context	N
Welke-Tonkonoh	52
Stewart	9
Stephenson	5
Other Sites	5
Isolated Surface Finds	19
Total	90

Table 2: Condition of Point Sample.

Condition	N	%
Relatively Complete	73	81.1
Base	12	13.3
Fore-Section/Blade Element	4	4.4
Lateral Edge Fragment	1	1.1

Table 3: Lithic Material Types: Points

Lithic Source	N	%
Kettle Point	29	32.2
Onondaga	7	7. 8
Bayport	6	6.7
Selkirk	1	1.1
Haldimand	33	36.7
Unknown	14	15.6

With reference to tool use, Frison (1968) and others have documented vast formal changes associated with little functional change, or, as another alternative, formal change associated with extensive change in use. Recognition of these changes are essential to understanding the exact nature of the "tool kits" and activities carried out on a site. Again, this factor suggests that life history studies focusing on morphological change are a necessary pre-requisite to use studies or, alternatively, they should be carried out in conjunction with such use studies. In the present study, some suggestions as to tool use will be presented based on gross morphological characteristics. We present these as a possible guide to future research, since “proper" use studies require extensive experimental replication and use as well as detailed microscopic analyses. Nonetheless, as will become clear below, there are major morphological alterations to Hi-Lo points that, using criteria we have employed elsewhere such as working edge morphology (e.g. Ellis and Deller 1988:125-128), clearly signal differences in the specific use of these tools – even though those specific uses may be presently unknown. Moreover, these suggestions of use changes, which essentially indicate Hi-Lo points were used in many different ways beyond use as projectiles, need to be considered in attempts to understand whether Hi-Lo is derived from previous Holcombe industries or outside the region. It is also essential to evaluating why their frequency of occurrence differs from that of other Paleoindian to Early Archaic point forms.

Table 4: Descriptive Statistics, Hi-Lo Points.

Variable	N	Mean (mm)	Standard Deviation	Range (mm)	Coefficient of Variation
Total Length	52	39.65	7.26	26.0-59.0	18.31
Fore-Section Length	53	30.09	7.30	13.5-46.0	24.26
Maximum Fore-Section Width	70	23.70	2.55	18.0-29.5	10.76
Maximum Fore-Section Thickness	71	8.16	0.97	6.5-11.0	11.89
Shoulder Width[a]	73	23.35	2.52	18.0-29.5	10.79
Haft Length	72	10.00	1.62	7.0-13.0	16.07
Length of Basal Thinning[b]	83	10.72	2.73	5.0-19.5	25.42
Length of Lateral Grinding	121	9.76	1.58	5.5-13.0	16.19
Hafting Width[c]	73	20.23	2.82	13.0-25.0	13.94
Hafting Thickness[c]	75	6.13	0.77	5.0-8.0	12.56
Basal Width	54	20.51	2.55	12.5-24.5	12.43
Basal Concavity Depth	52	2.80	0.91	1.5-5.5	32.50

a: width across shoulders or at top of lateral grinding; b: based on longest thinning flake on a face; c: measured at juncture of shoulders and lateral basal edge or at top of grinding.

Table 5: Preform Variables and Material Types.

Type	N	Length		Width		Thickness		Material
		Range	Mean	Range	Mean	Range	Mean	
Thinning Stage	3	67-70.5	68.75	34-34.5	34.25	11-13	12	Haldimand: 3
Retouching Stage	3	49-66	59.80	24.5-32	28.20	10-11.5	10.66	Bayport: 2 Kettle Point: 1
Direct Thin Flake	1	-	45.5	-	25.5	-	10.5	Haldimand: 1

In the following sections, first, the nature of the Hi-Lo artifact sample used in this analysis is presented. Second, a description of Hi-Lo points emphasizing formal variation within the type is given. In the subsequent sections, attention is focused on delimiting the form of "finished" Hi-Lo points prior to breakage and reworking and on how breakage in use, edge dulling and resharpening changes the form of finished points. Finally, conclusions resulting from the analysis are presented.

THE SAMPLE

The total artifact sample used in this study includes 90 points and seven preforms. The vast majority of these artifacts are from three sites located just west of London, Ontario: Welke-Tonkonoh (AfHj-5), Stewart (AfHj-6) and Stephenson (Figure 1; Table 1). Materials from several other smaller sites as well as isolated surface finds from other localities are also included, many of which were loaned to us from local farm collections. The condition of the point sample is shown on Table 2. Data on lithic material sources is given on Figure 1 and Tables 3 and 5 while descriptive statistics for points are shown on Table 4 and for preforms on Table 5.

DESCRIPTION OF HI-LO POINTS (see Figures 2 to 4)

Haft Elements

Lateral Edge

The lateral basal edges range from items with slightly incurvate sides to items that appear side-notched, albeit shallowly. Such lateral edges are always heavily ground.

Basal End

The basal end is slightly to moderately concave and varies considerably as measured by the coefficient of variation (see Table 4). The base also exhibits a light to heavy grinding and "ears". These ears vary considerably in terms of width and thickness, range in outline from squarish to rounded to pointed and are often asymmetrical in size and shape on the same point (i.e. Figure 3a-right).

Facial Attributes

Bifacial basal thinning is always present. This thinning is usually accomplished by the remova1 of one or more parallel-sided flakes or occasionally, by the removal of a single, broad, expanding flake either alone or in conjunction with the parallel-sided thinning. Usually, these thinning flakes originate in the basal concavity but in two cases, they have been removed using an ear as a striking platform. As indicated by the relatively high coefficent of variation, the length of these thinning flakes varies considerably (Table 4) but only rarely does the thinning extend up the face of the point beyond the extent of the lateral grinding or, if present (see below), the shoulders that define a stem area. In those rare cases, the longer thinning flakes might be considered long enough to be “flutes” but these example seem fortuitous – there seems to have been no consistent attempt to remove those long flakes from the base but simply on occasion one carried a little farther. The blade element beyond the basal thinning is much thicker than the haft element. Often, there is a distinct lateral thinning on one face just below the shoulders, which involves the removal of one or more parallel-sided flakes, precedes the basal thinning, and is accomplished from one lateral edge (predominantly the right).

Fore-Section (Blade) Elements

General Comments

These elements vary considerably in length (see Table 4). Tips range in outline from pointed (Figure 3d) to blunt (Figure 3a) and from narrow to wide. At the juncture of the blade with the haft element, many points have distinct rounded shoulders (or phrased another way, a distinct stem) while others have only a much reduced “nubbin” remnant of those shoulders (Figure 2g, 3a) or have a shoulder on only one lateral edge; e.g., Figure 3h). Maximum point width and thickness can occur anywhere from the blade mid-point to the shoulder/top of lateral grinding.

Lateral Edge Configuration

Four varieties of lateral edge configuration can be noted, referred to as excurvate, parallel, straight and recurvate (Figure 5). Excurvate lateral edges form one continuous "outcurve" relative to the medial axis of the point from the shoulder area to the tip. This shape is the only edge configuration that can occur with a maximum blade width greater than that in the shoulder area. Parallel is used

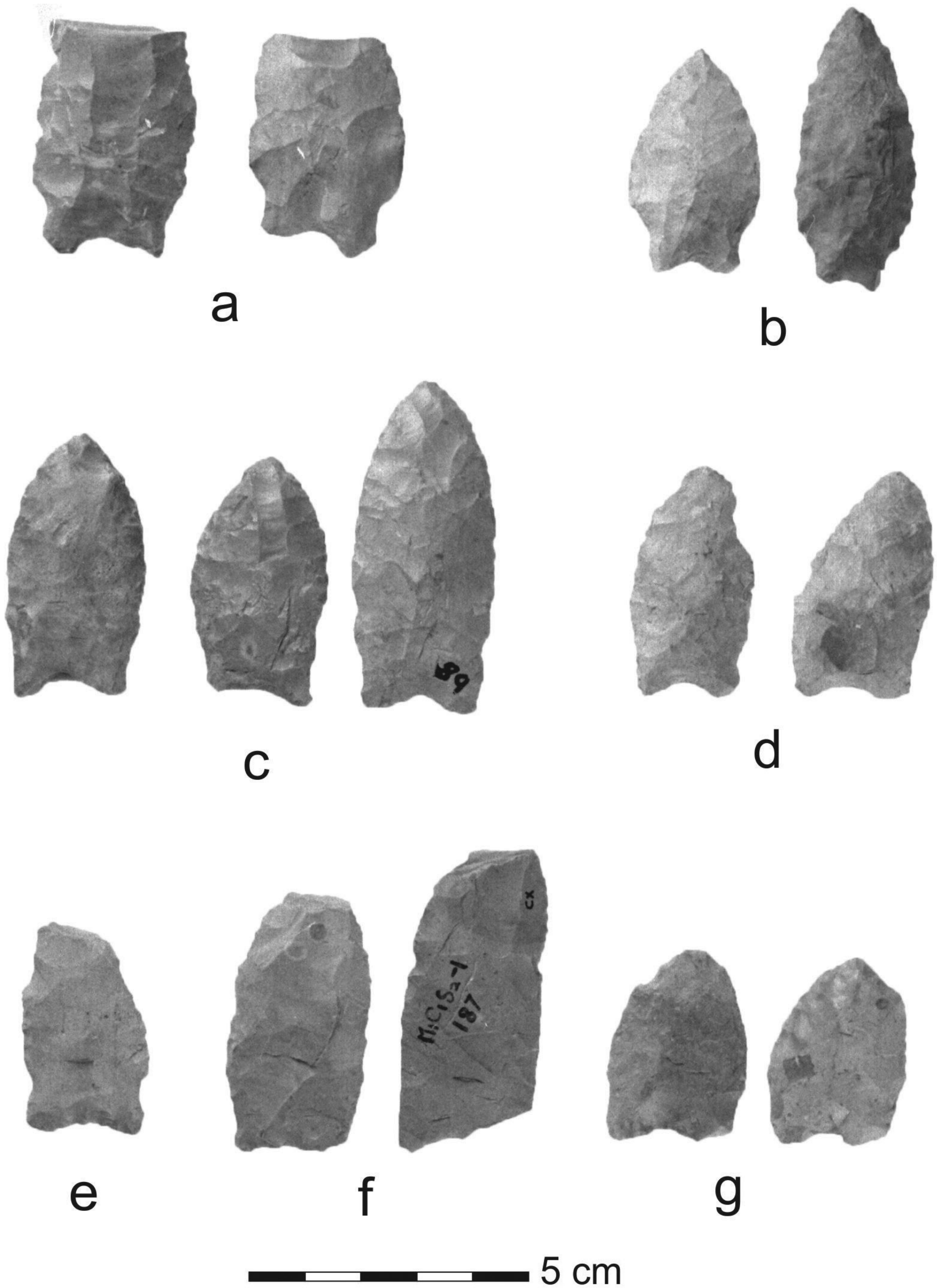

Figure 2: Hi-Lo Point Serial Outputs Representing Life History Pathway #1. A: SO2; B: SO3; C: SO4; D: SO5; E: SO6; F: SO7; G: SO8.

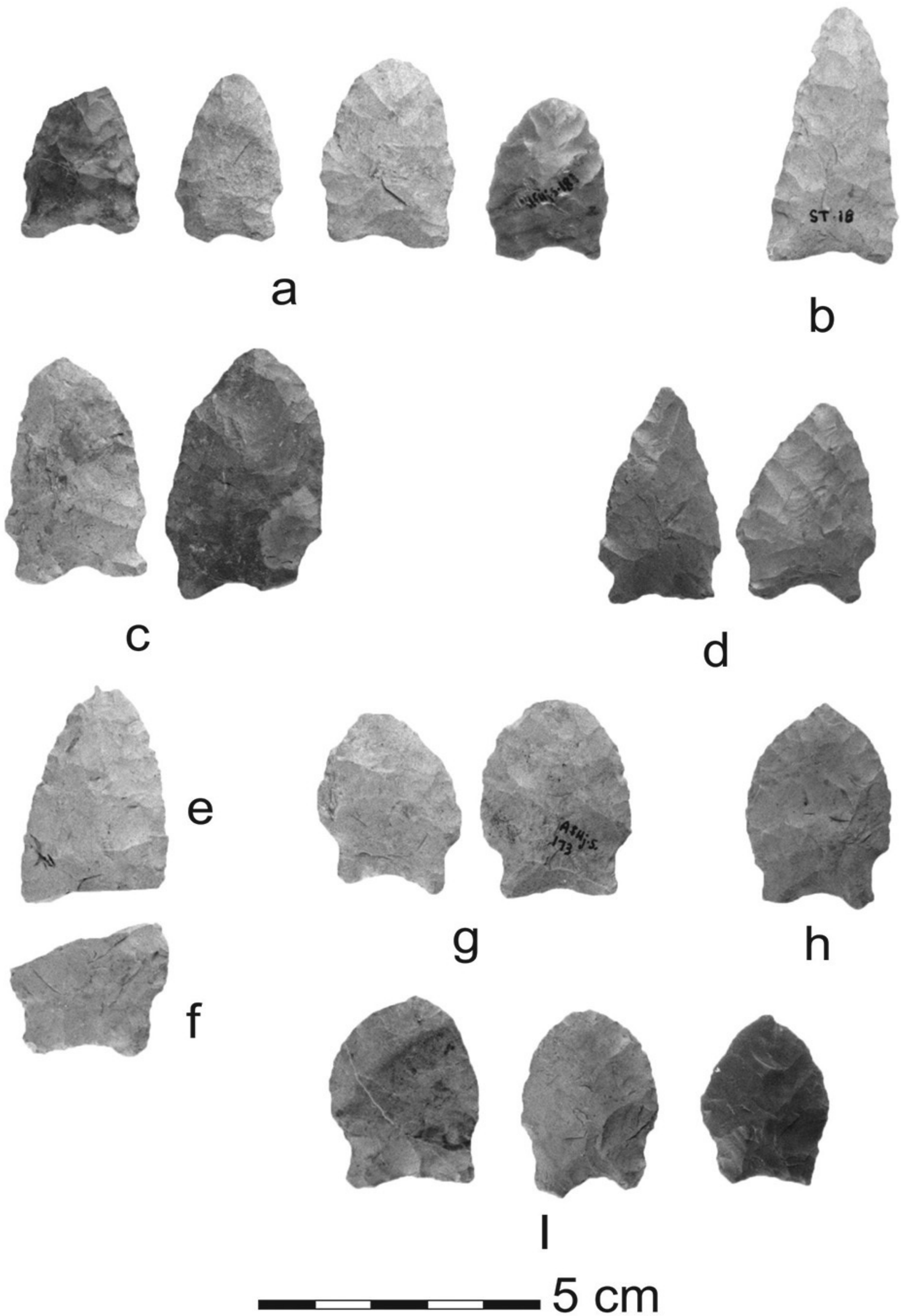

Figure 3: Hi-Lo Point Serial Outputs Representing Life History Pathways #1 to #3. A: SO9; B: SO11; C: SO12; D: SO13; E: SO14; F: SO15; G: SO16; H: SO17; I: SO18.

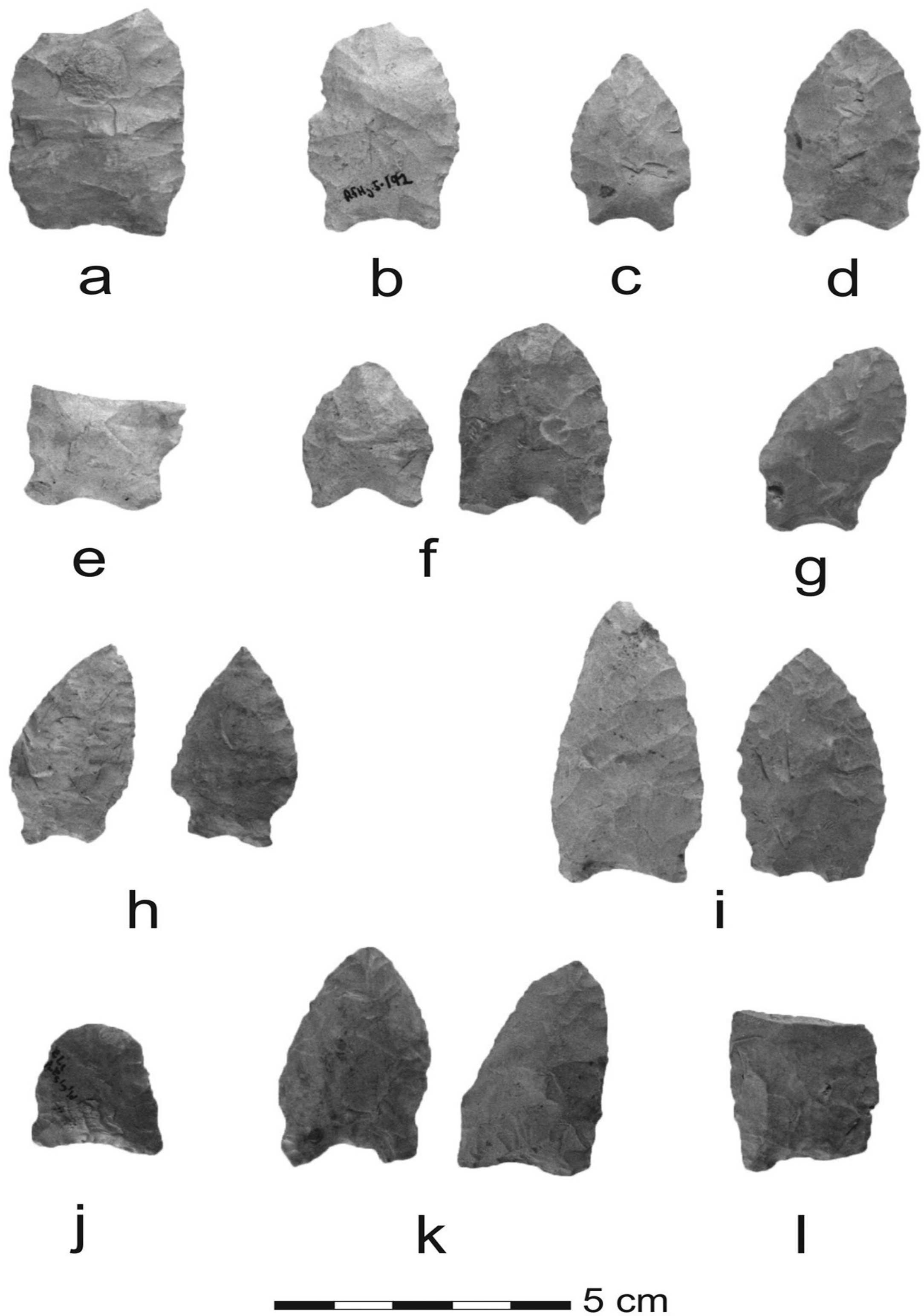

Figure 4: Hi-Lo Point Serial and Direct Thin Flake Outputs Representing Life History Pathways #1 to #4. A: SO21; B: SO22; C: SO23; D: SO24; E: SO27; F: SO28; G: DO1; H: DO3; I: DO4; J: DO10; K: DO25; L: DO26.

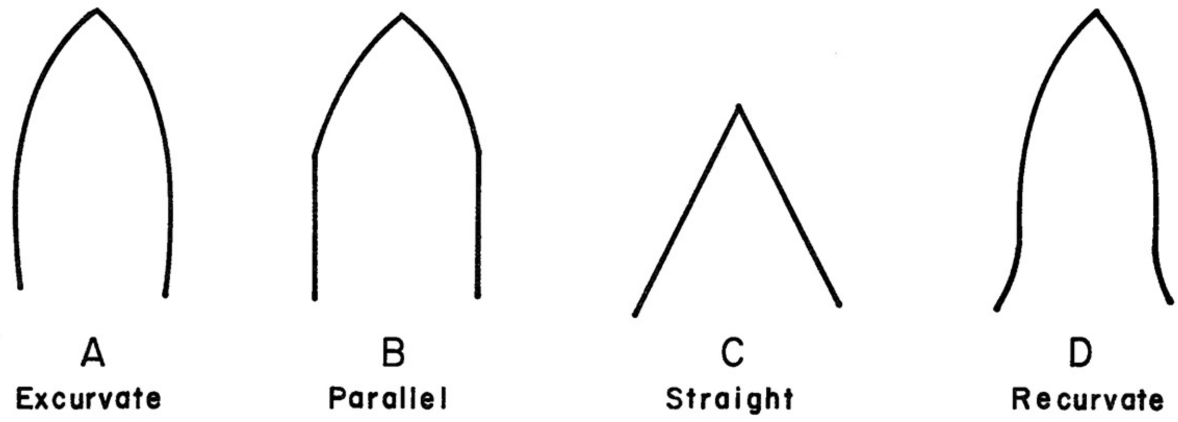

Figure 5: Point Fore-Section Lateral Edge Configurations.

to refer to points with at least one lateral edge which parallels a line drawn down the medial axis of the tool from the shoulder/grinding area to near the tool tip. At this distal end the edge curves to a rounded or pointed tip. If the parallel lateral edge occurs on both margins, maximum blade width occurs from the shoulder area to just short of the tip. Points with at least one parallel lateral edge are rare in the sample (four cases). Straight edges are straight with maximum width at the shoulder, and these edges converge to form a triangular blade (see Figure 3d, 5c). Finally, excurvate edges are “incurved” towards the blade element but change to excurvate as the edges converge to form the tip. By definition, maximum width occurs in the shoulder/grinding area.

Cross-Sections

In longitudinal section, blade elements range from straight to slightly curved while in transverse cross-section (e.g., form side to side), the blade can be biconvex, plano-convex or "twisted". This twisted cross-section results from alternate edge beveling (see below). Viewed tip-on in transverse section, the blade appears twisted relative to the axis of the base and in some cases, approximates a parallelogram or rhomboid cross-section.

Edge Beveling

The lateral blade edges are often beveled. In all but three instances, such bevels are produced by a bifacial edge retouch rather than the "pure" unifacial retouch characteristic of some industries such as Dalton (Goodyear 1974). This beveling occurs on 58 or 65.9% of the 88 points in a suitable condition to determine this sharpening mode. The most common form of beveling (53 or 91.4%) occurs on alternate blade faces. On 41 or 77.36% of these alternately beveled points, the bevel occurs on the left edge when the point is viewed face on with the tip to the top. In the other alternately beveled cases, the bevel is on the right edge. The remaining five beveled points are only beveled on one left edge (e.g., Figure 4g). These percentage counts and frequencies do not include points with bevels achieved by what is defined below as "scraper retouch".

Flaking and Edge Retouch

While some points exhibit a well-executed collateral to rough parallel retouch (Figure 3e), most points show no consistent pattern or orientation to removals. For our purposes, three forms of edge retouch can be delineated. The first includes beveling that, as noted above, is produced largely by a bifacial edge retouch. This bevel is attained simply by removing more of the edge mass from one

face of the edge. The flakes from the beveled face are usually quite long and extend to or beyond the mid-line of the tool. Such removals are often overlain by a few, discontinuously distributed, small, short flake scars.

A second form of beveling is referred to here as "scraper retouch". Given the consistent application of this retouch to edges of a certain form and also, that it occurs on points reworked into end scrapers or over heavily damaged and impacted but otherwise unreworked edges, this retouch is interpreted to signal a functional modification of point forms. Such a retouch occurs only on previously thin, acute edges and results in edge angles between 45º and 55º. It is achieved unifacially; is continuous and patterned in its distribution on and application to an edge; and is very fine, flake removals being narrow (less than 3 mm) and short (less than 4 mm).

The final edge retouch form is referred to as bifacia1-symmetrical. The form and pattern of flake removals vary considerably. The main features which help to distinguish it from the previous two retouch forms are: it is bifacial and also, it involves removing equal amounts of edge from both faces of a tool edge (i.e. it is symmetrical and does not produce bevels/twisted transverse sections).

Use Modifications

Several points exhibit modifications that are easily interpreted as indicating a change in tool use(s). Scraper retouch, which results in end and side scrapers, has been previously mentioned. Other modifications include small notches, “rod-like” (e.g., drill-like) fore-sections, larger carefully chipped "spokeshave" notches and pointed projections, referred to here as "perforators".

MANUFACTURING

Two manufacturing sequences for Hi-Lo points can be delineated (Ellis 2004b:6). The first sequence is referred to as serial biface reduction (Knudson 1973). In this reduction sequence, the knapper starts with a core or flake blank much larger than the finished point and, by following generally a three procedure sequence, manufactures this blank into a finished point form. The three procedures are: 1) the creation of a bifacially chipped margin on the blank set up to allow subsequent thinning flake removals; 2) the removal of several large, broad flakes to thin the large mass constituting the original blank and to obtain a desired transverse cross-section; and 3) the retouching of the successfully thinned reduced mass to a form with the desired outline shape and surface finish of the completed point (see Bradley 1974:192; Callahan 1979; Henry et al 1976; Muto 1971; Newcomer 1971). While these three procedures are largely carried out in sequence, they grade together and should not be seen a having rigidly demarcated boundaries separating each stage during biface production.

Evidence of serial biface reduction is found among the preforms in our sample. Those preforms associated with this reduction strategy can be placed into two types. The first includes three specimens (Figure 6a, b, c; Table 5), which are classified as thinning stage preforms because they exhibit surfaces covered by several broad, expanding, thinning flake scars. These thinning flakes were removed from edges strengthened by continuous beveling. Use of flake blanks, albeit large ones, is indicated by one preform (Figure 6a) with a platform remnant at what would have been the tip end of the completed point had the preform been further reduced. Whether core blanks were also used for serial biface reduction is unknown. Another preform (Figure 6b) has clearly been used. A glossy “polish” is found on and extending back from the edges on flake scar intersections for up to 6 mm. It is not clear in the case of either of these preforms why they were discarded without further reduction but the bend break on the third preform (Figure 6c) suggests manufacture breakage.

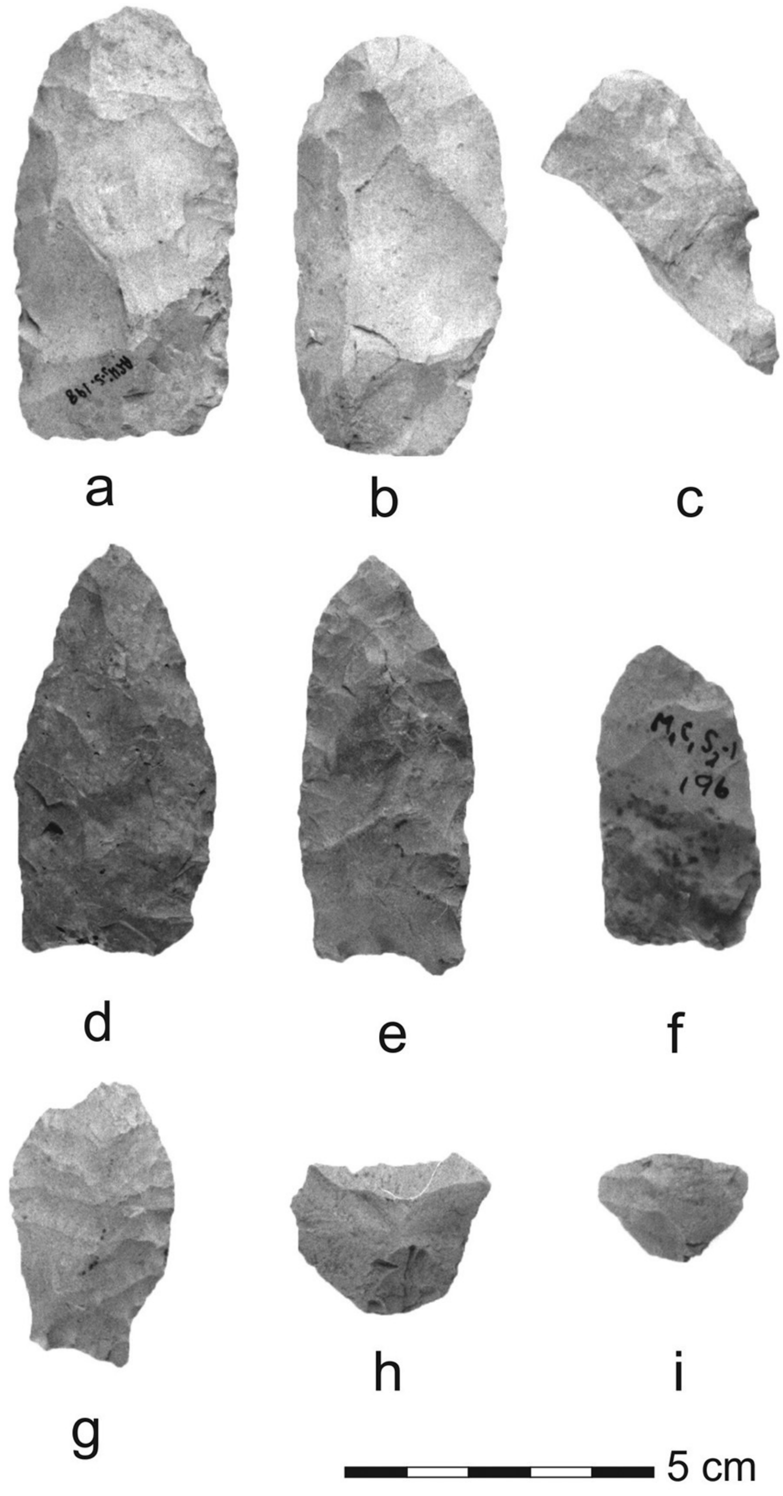

Figure 6: Hi Lo Point Preforms (A-G) and Retouched Biface Thinning Flakes (H-I). A-C: Thinning "stage" preforms produced in serial biface reduction; D-F: Retouching "stage" preforms produced by serial biface reduction; G: Point preform made directly on thin flake; H-I: Biface thinning flakes with retouch at distal end.

The second preform type includes three specimens (Figure 6d-f; Table 5), called retouching stage preforms because they are believed to be within the third stage of serial biface reduction outlined above. In size and shape they resemble the less resharpened finished points but they lack basal and lateral grinding and possess only a minimal amount of fine retouch. Evidence of the preceding thinning stage is represented by portions of large thinning flake scars on all three of these preforms. Although these preforms exhibit attributes suggesting they are unfinished, all appear to have been reworked and used, possibly as unhafted tools. In one case (Figure 6d), the reworking has involved the production of a very steep (ca. 75°) bevel along one lateral edge. The edge retouch used to form this bevel and the very short and fine retouch along the opposite lateral edge is the only instance of fine retouch on the blade of this preform, a unique incidence among beveled tools in the present sample. The base, however, appears finished except for lateral and basal grinding. This preform and one other (Figure 6d, e) were apparently not finished because of impurities or flaws in the raw material. In the case of the third (Figure 6f), the reason for its abortion is unclear.

The second distinct manufacturing sequence involved in Hi-Lo point

production is direct thin blank manufacture. In this sequence, the knapper selects a blank only slightly larger in width, thickness and/or length than the finished point and, to a certain extent, simply retouches the blank into a finished shape. This sequence differs from serial biface reduction in that not as much waste is produced in altering the blank; thinning and finishing of outline and surface tend to be somewhat co-extensive rather than mainly sequential procedures; large, long, broad thinning flakes are rarely produced; and the preform does not go through a series of large variant biface forms prior to finishing. Furthermore, because the blank is not much larger than the finished point and has not been extensively reduced, points manufactured in this manner exhibit certain marked attributes reflecting the original blank form. These attributes include one or more of the following: 1) especially thin blade elements on long points; 2) pronounced plano-convex transverse cross-sections; 3) some retained curvature in longitudinal section; and 4) large surfaces covered by remnants of the original interior (ventral) surface of the blank or of bedding planes in the lithic material, which may represent dorsal or ventral surfaces of the asymmetrical blanks.

One possible preform associated with this direct blank reduction was recovered (Figure 6g; Table 5). Although this “preform" has basal and lateral grinding, it appears somewhat "crude" and one surface is almost completely covered by an original flake blank ventral facet. A possible functional modification in the form of a small chipped notch is found near the tip.

Factors governing the use of one or the other of the above manufacturing sequences are not clear. Several explanations used to explain variation of this nature are to be found in the available literature. The first suggests that the use of one or the other of the reduction sequences is dependent upon the size or the presence of material flaws in the stone at the source (Knudson 1973; Fitting et al 1966:61). Careful evaluation of the efficacy of this explanation would necessitate a large sample of points as well as data on lithic source locations and the naturally occurring form of such material. Furthermore, it would entail accurate placement of points into categories produced by the two reduction strategies. In many cases, this accuracy is not possible because the points have been heavily reworked after finishing and thus, possible evidence of blank reduction methods are obscured. Given these considerations, this explanation based on material qualities cannot be easily evaluated. However, the Haldimand chert that was largely preferred by Hi-Lo knappers in southcentral Ontario does tend to occur in smaller pieces that other materials such as Onondaga and these smaller masses may have restricted blank size.

A second explanation may be that thin flake manufacture could have been favoured by novice or less-skilled knappers. If one can find a small blank of the appropriate morphology and size that can be successfully made into a minimally acceptable finished point form, one can avoid the skill need to extensively and uniformly thin the blank/preform as is required for serial biface reduction.

A third explanation suggests that the use of a specific reduction sequence depends upon constraints governing access to and transportation of lithic materials – such as distance to source (see, for example, Ellis and Spence 1977:132-133). If the lithic material is intended to be used where there is no easy access to such materials, the transportation of biface preforms in the earlier stages of serial biface reduction allows for a more extensive use of a smaller amount of lithic material than does a direct blank manufacture approach. These advantages of serial biface reduction include first, the ability to use the variant sequential biface forms as unhafted tools prior to manufacture into points (Judge 1970, 1973, 1976:59-60; Huckell 1979:183-184) and second, the fact that the by-products of a serial bifaces reduction may be used (Judge 1973, 1976:60-61). Also, larger biface preforms are less likely to incur transport damage that would impair transforming the preform into a finished object (Ellis and Spence 1997). Evidence to support such an argument in the Hi-Lo case, although sparse, includes the definite use of one of the three thinning stage preforms and the retouching of known Hi-Lo biface thinning flakes into end scrapers and other tools (Figure 6h-i; see Ellis

2004b:11). This third explanation would entail that direct blank manufacture would be employed in areas where there is easy access to lithic material and hence, no need to extend the use-life of a given piece of lithic material or, perhaps, where blanks suitable for serial biface reduction are not available. Additional testing of this explanation requires a larger preform sample and, as with the previous explanation, more data on a range of sites at varying distances from lithic material source locations.

In the Hi-Lo case, a fourth explanation for blank reduction strategy selection may be relevant. It may be that serial biface reduction was the preferred sequence because such a reduction does not result in marked attributes of the original blank form appearing on the finished point - attributes which may limit the application of certain "stylized" (i.e. dominant) sharpening modes such as edge beveling. Thorough testing of this explanation is not possible lahrgely because we still do not fully understand the factors governing the application of alternate edge beveling or other resharpening modes or, for that matter, the specific uses of Hi-Lo points. However, this explanation is suggested because, as will be discussed later, it can be shown that some points definitely produced by direct blank reduction have been resharpened differently than those resulting from serial biface reduction. Acceptance of this explanation would necessitate the belief that direct blanks were only used under conditions similar to that given for the third explanation above.

THE FINISHED POINT

The above discussions has indicated that some of the variability in Hi-Lo point morphology, such as in transverse and longitudinal section, is due to the application of different blank selection and reduction strategies. Also, some difference as between stemmed and shallowly side-notched variants may be monitoring temporal changes over the long period of 200-300+ years Hi-Lo points may have been in use. However, as implied above, there is still considerable other variation in several point attributes. It is suggested that this variation is largely the result of the differing life histories of points after they were manufactured (that is after they were first used as parts of hafted/composite tools). In order to delineate these post-manufacturing histories, it is necessary to have some idea of the point form prior to use, breakage, edge dulling and reworking. This form will provide a base-line against which to match the present sample. In some instances, such as in Dalton (Morse 1971), the recovery of points in cache situations where many points were "prematurely" removed from their cultural context has provided such a base-line. In Hi-Lo this is not the case and a more circuitous route is needed in order to establish the "original" point form.

Characteristics of "original" points are listed below and their means of delineation is discussed. In this discussion, a conceptual distinction is made between "longitudinal", "lateral" and "diagonal" resharpening. Longitudinal refers to reworking that results in changes in tip configuration and blade length while the lateral refers to reworking directed laterally which reduces the width of the "original" point form and alters lateral edge configuration. Diagonal refers to special cases of fore-section/blade reworking where there has been an extreme emphasis on flake removals directed diagonally to the distal corners of the fore-section element to produce straight lateral edges and very pointed tips (e.g., Figure 5c).

"Ears" and Basal Concavity Depth

It is suggested that the ears on finished unreworked points were symmetrical in size and shape and were, large, thick and rounded to squarish in shape. Furthermore, it is suggested that basal concavity depth approximated the maximum depth of the range shown on Table 4.

The ears on the available point sample are often damaged. This damage includes "pseudo-burin" blows up the lateral edge as well as simple snapping across the ear at or near its juncture with the base. In 12 cases, these breaks have been partially reworked or ground over. The result of such reworking is an asymmetry in ear size and shape between the reworked and unreworked ear. The most common ear form resulting from this reworking is a short, narrow, thin, pointed form (i.e. Figure 3a-right). Continued reworking of this nature results in a shorter haft element and a shallower basal concavity. If the haft element is significantly reduced in size, given the thick blade element of the point, the point base probably could not be inserted properly in the haft. At this juncture, the base would be rethinned. In two cases, this procedure was carried out using an ear remnant as an isolated platform (see Frison and Bradley 1980:30-31) to remove the thinning flake.

Shoulder

There is good evidence that all Hi-Lo points exhibit a shoulder prior to lateral resharpening. Points with little lateral resharpening have the most pronounced shoulders (Figure 2a, b) while more extensively resharpened points show only a "nubbin" remnant of these shoulders (Figure 2c-left). In a few cases with very narrowed fore-sections (presumably due to resharpening; e.g. Figure 4f) there can be no shoulder making it difficult to distinguish such items from the more Holcombe-like or Hi-Ho forms although more concave lateral basal edges or shallow notches and/or larger rounded ears usually help to recognize Hi-Lo points amongst those particular items. Also, there are some points in which lateral resharpening has been asymmetrical. As a result, the shoulder appears on only one lateral edge (e.g., Figure 2d-left, 3h, 4i).

Beveling

It is assumed that finished, unreworked points were not edge beveled as has been demonstrated in other industries where beveling is present (Frison and Bradley 1980:82; Goodyear 1974; Morse 1971; Sollberger 1971). While it can be demonstrated using other criteria of resharpening such as a reduced shoulder, that beveling was a component of lateral and diagonal resharpening in Hi-Lo, it cannot be conclusively demonstrated that unreworked points lacked bevels, especially given that one preform exhibits a bevel. However, as stated above, the combination of attribute states on this preform is unique among the sample and it is assumed that this preform was simply reworked to serve other non-projectile point uses because material flaws prohibited its being finished into a point. Furthermore, it should be noted that although the base of this preform is finished (except for lateral and basal grinding), the lack of a well-defined shoulder indicates reworking of this beveled edge.

Fore-Section (Blade) Length

Fore-section length is one of the most variable characteristics of Hi-Lo points as indicated by the high coefficient of variation (Table 4). Fitting (1975:42), in noting this considerable variation in blade length, has suggested that the short points are largely a result of what is phrased here as longitudinal resharpening. That is, the blade element gets broken and is retipped resulting in shortening of that element. In the present sample, definitive evidence of resharpening of this nature includes eight points where tip impact fractures have been removed at the tip (but not on the retained face of the point) by resharpening, as well as two points which have been partially reworked across a transverse fore-section break. Based on these data, and the fact that the preforms in the sample are quite long (see Table 5), and given the length of some apparent unresharpened snapped fore-sections (Figure 3e), it is suggested that finished Hi-Lo points exhibited long blade elements approximating the upper maximum of the variation present in the sample (ca. 40-50 mm; see Table 4)

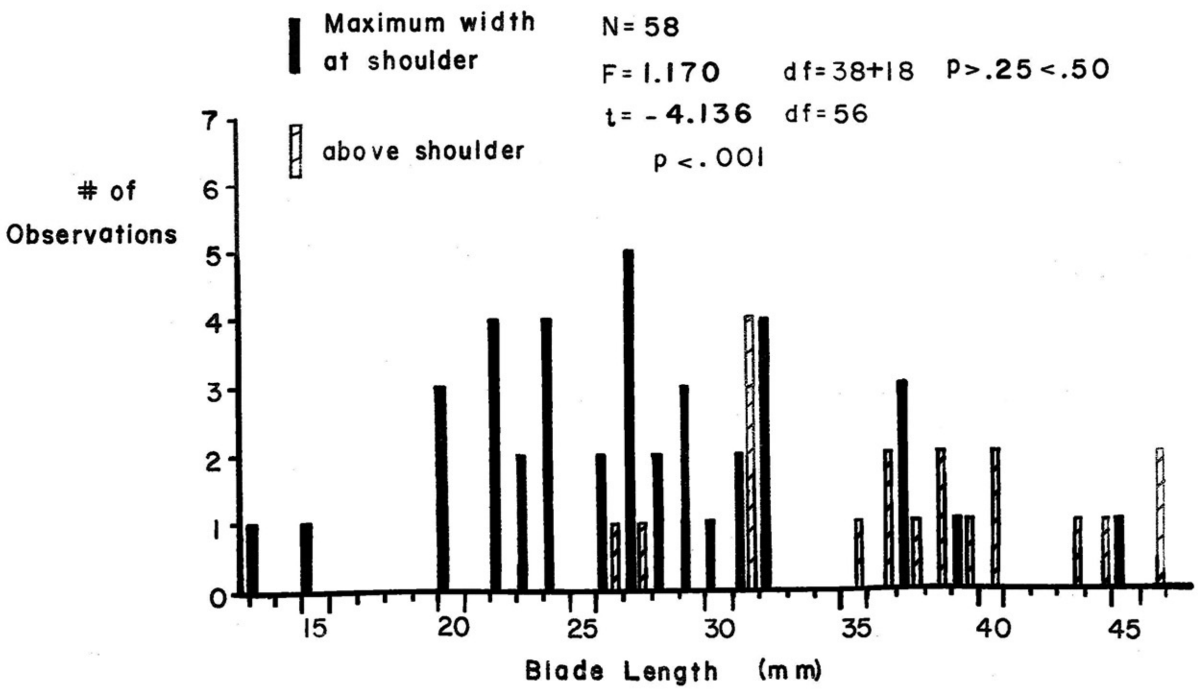

Figure 7: Maximum Width Location by Fore-Section (Blade) Length.

Position of Maximum Width

Given that the longer fore-section elements should be characteristic of little or no longitudinal resharpening, it is possible to correlate blade length with other attributes. Figure 7 shows that on longer fore-sections, maximum width tends to occur above the shoulder/top of the lateral basal lateral indentation. Points with parallel lateral edges on both margins were assumed to have maximum width above the shoulder for purposes of this correlation.

Lateral Edge Configuration

The position of maximum width correlation for longer fore-sections noted above entails the idea that little or unreworked points had excurvate or parallel edges since these are the only edge configurations with which maximum width can occur above the shoulder. Given that the only four points in the assemblage with at least one parallel lateral edge have highly reduced shoulders (i.e. they have been laterally resharpened), then it is probable that unreworked points had excurvate lateral edges. This does not mean to imply that excurvate edges cannot occur on laterally reworked points – they do on items that have not been subjected to much edge resharpening.

Tip Shape

There is some suggestion that unreworked points had pointed tips. Again, in order to test this possibility, an attempt was made to see if longer bladed points had sharp pointed tips. Originally, in order to try and objectively make such assignment, attempts were made to trace tip outlines on graph paper and to measure the angles of the converging lateral edges. While this measurement was relatively easy to accomplish on narrow pointed tips, it proved impossible to measure the angle accurately on wider, somewhat blunt tips with more rounded ends (i.e. Figure 3 a, g, i). Therefore,

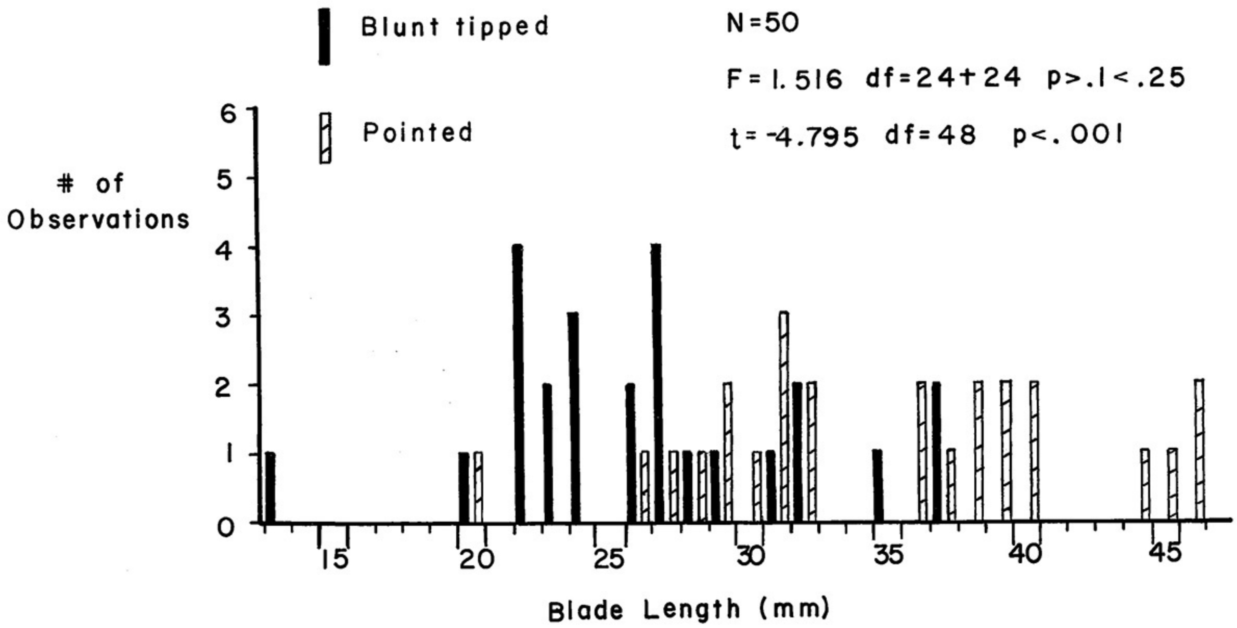

Figure 8: Blunt and Pointed Tips by Fore-Section (Blade) Length.

two other estimates of tip "pointedness" were employed, neither of which is, in its own right, totally satisfactory.

The first estimate involved simply a value judgement and placement of points into blunt tip and pointed tip categories. The previous outline tracing method was used to aid in this value judgement for points in the sample that were immediately accessible (some of the original point samples had been returned to collections). In short, if the angle was difficult or impossible to measure, the point was placed in the blunt tip category. Figure 8 shows the results of this classification. Based on the results of this operation, it is clear that all points above 37 cm in length have pointed tips and that points below 26 mm rarely have such tips.

A second method was also used to try and objectively test the results of the previous measure. In this case, the width of the tip was measured at a constant distance from the tip (3 mm) by placing the tip straight down on a flat surface and bordering it on two sides (i.e. the lateral edges) with the prongs of a 3 mm thick caliper. These prongs were in turn, closed until they made contact with the lateral point edges. Points in the sample which were not immediately accessible (i.e. they had been returned to their respective collections) were omitted from this test. Such a technique is not entirely an accurate measure of tip shape since it is dependent on blade width and hence, the nature and degree of lateral resharpening. For example, there are "short-bladed" points (i.e. Figure 3a-left) or "long-bladed" points (i.e. Figure 3b) that have blunt but somewhat narrow tips and were classified as blunt in the previous method. However, using this method, they were considered pointed.

A scattergram of this tip width by blade length based on these measurements is shown as Figure 9. This figure tends to confirm the results of the previous method of tip form classification. Again, all points beyond ca. 37 mm in blade length have narrow (below 9 mm wide) tips and, by extension, are inferred to have somewhat pointed tips. Conversely, blunt tips are restricted to the "shorter-bladed" points in the assemblage.

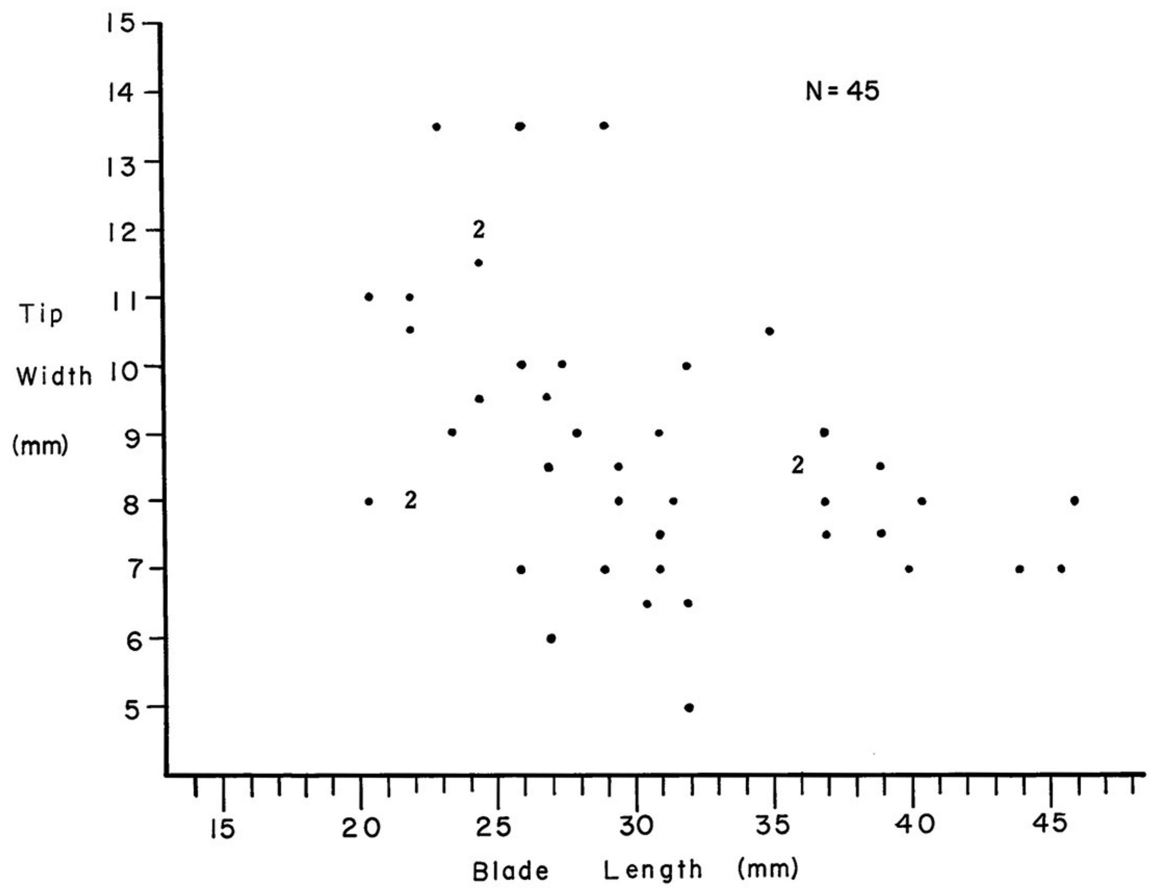

Figure 9: Scattergram of Tip Width by Fore-Section (Blade) Length.

Surface Flaking

Based on the above attribute states, no complete points in the available sample are in their "original" form prior to reworking – this conclusion is to be expected in a used and discarded assemblage. However, several points, including fragmentary (i.e. transversely snapped and tip impacted forms) and relatively complete points approximate the original form (e.g., Figure 3e). These points suggest that the well-executed collateral to rough parallel flaking is a characteristic of unresharpened points while the erratic non-patterned flaking is characteristic of more reworked points. Such a contrast between unreworked patterned flaking and reworked "erratic" flaking has been noted as a characteristic of point reworking in other industries (Frison and Grey 1980:30; Wheat 1975).

Summary

To summarize, it is concluded that the unreworked Hi-Lo point was characterized by long blade elements with maximum width on the blade, excurvate lateral edges, an unbeveled transverse cross-section (biconvex to plano-convex), a well-executed collateral to rough parallel flaking, shoulders at the top of a stem or shallow notches, and a pointed tip. Haft elements had fairly deep basal concavities and large, thick, roundish to squarish ears which were symmetrical in shape on the same point. Basal thinning was accomplished solely from within the basal concavity rather than from the

ears. A blade and a base of such a form are shown in Figure 3e and 3f positioned in such a manner to illustrate this original form.

REWORKING

Using the above conception of the "origina1" form, variance between this base-line original and the characteristics of the available sample has been used to construct a point life history classification in which the various morphological variants are arranged as outputs in a flow model; that is artifacts during their lifespan move through the system being modified in various ways and eventually are discarded or output into the archaeological record. This flow model, as shown on Figure 10, appears somewhat complex. Part of this complexity is a direct result of the fact that on heavily reworked points, the earlier reworking is obscured due to continued biface reduction. This difficulty is reflected in the tendency of the various pathways to converge on certain outputs at the bottom of the diagram. Nevertheless, since it is a model it has been somewhat simplified. For example, the model does not consider haft element reworking. Also, the model shows only those categories that are represented in the point sample -- although it logically entails other categories that are not represented. The best example of these exceptions are transverse snaps, which result in a blade and a base fragment. Since, in some cases, a blade or a base was not present (or, it could not be demonstrated that the available bases were the result of a particular reworked form), these outputs are omitted.

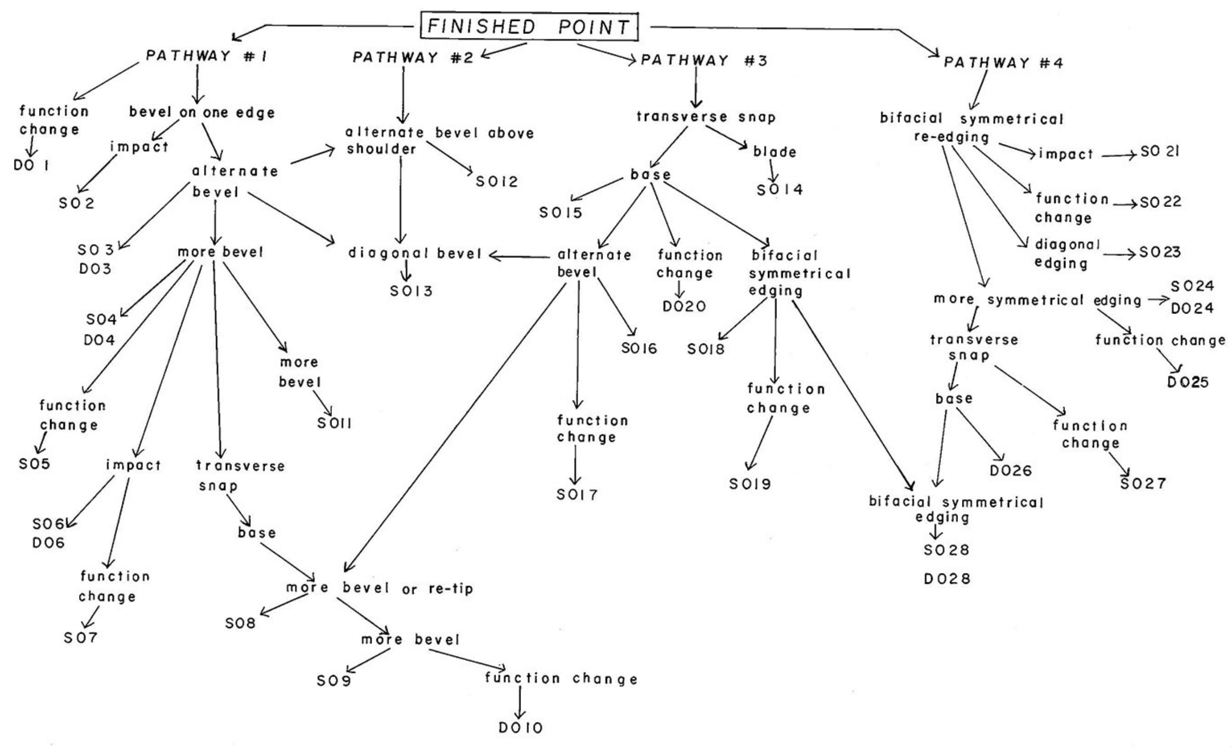

Figure 10: Complete Flow Model Showing Hi-Lo Point Life Histories and Outputs.

In addition to the above, certain simplifying assumptions have been made. First, the model assumes that once a point was functionally modified by the addition of scraper retouch, notches etc., it was not further reduced into still other forms. Second, the assumption was made that once a given point was symmetrically-bifacially re-edged, it was not resharpened by beveling or vice versa. Third, the

model minimizes the number of transverse snaps but of course a single long point could be snapped and retipped more during its use-life.

In the following, the various outputs of the model are described and their place in the model is discussed. Each distinct output form is assigned a number. This number is prefixed by "DO" for direct blank manufacture or “SO” indicating probable manufacture by serial biface reduction. With regard to "SO" outputs, it should be noted again that many of these may include points manufactured by direct flake reduction. However, as noted above, because of the small size of many points due to extensive reworking, evidence of direct blank reduction is difficult to determine on these points. Serial and direct outputs are assigned the same output number if they differ only in characteristics of the original blank such as cross-section but not in their post-manufacture/post-hafting life history.

For ease of comparison and description, the characteristics of each output form and how they contrast with each other in terms of blade reworking, breakage, possible functional modifications, etc. are shown on Table 6. Also, the outputs are discussed in terms of four general categories or "pathways" which are based on the initial life history of a given series of points.

Before proceeding, one last cautionary note should be given. Although the various outputs are arranged in a flow model, this does not mean that a point output early in the sequence is totally representative morphologically of a point output further in the sequence after additional reworking. In short, the very reason a point was output early in the flow model may mean that it was not suitable for additional reduction. Where possible, some reasons for the output of a given point "early" in the sequence will be suggested.

SERIAL BIFACE REDUCTION

Pathway # 1 (Figures 10, 11)

Points output within this pathway are characterized by an early life history in which the point was beveled while the blade element was still relatively long.

<u>Serial Output #2 (SO 2; Figure 2a)</u>

The points in this output are similar to the ideal "original" form except for extensive impact fractures at the tip (in one case this impact has driven a "flute" down the face of the tool to join the basal thinning’ [Figure 2a-left] suggesting it was launched with considerable force) and a light left bevel on one edge. This bevel has altered the lateral edge configuration so that one edge is only slightly excurvate compared to the more markedly excurvate opposite unreworked edge. However, a well-defined shoulder is still present on the reworked edge. Apparently, these points were lightly beveled on one edge, impacted through use, and then, discarded. It is suggested based on the one lightly beveled edge, that these points are intermediate in use-life between non-beveled and the alternately beveled forms of Serial Output #3 (see below).

<u>Serial Output #3 (SO 3; Figure 2b)</u>

These points are similar to the original form in that they have shoulders, excurvate edges, long blades and pointed tips. However, both possess an alternate bevel. One point is an isolated surface find and may have been simply lost as it certainly could have been continued to be used. The other point was probably discarded because of the hinging out of beveling flake removals that would have impaired additional lateral resharpening flake removals.

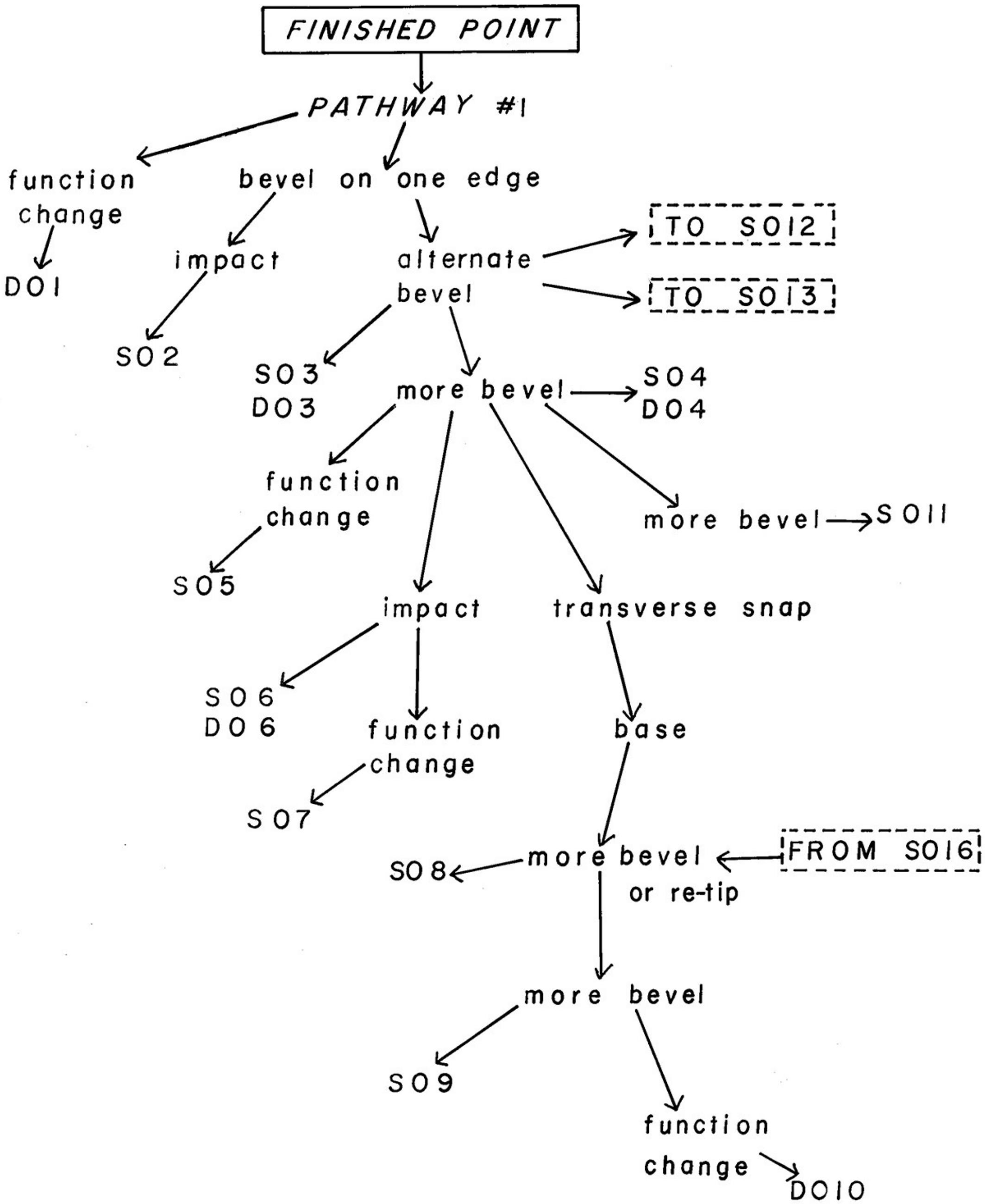

Figure 11: Segment of Flow Model Showing Hi-Lo Point Life Histories and Outputs in Pathway #1.

<u>Serial Output #4 (SO4; Figure 2c)</u>

The continued lateral beveling of SO 3 forms results in forms similar to those in this output. Such continued beveling has resulted in steeper bevels, only slightly excurvate to slightly recurvate lateral edges and the removal of the shoulder to the point where they are entirely absent or only a "nubbin" remnant is left. All of the points in this output may have been lost rather than discarded as they are all isolated surface finds and appear undamaged (one has a resharpened tip impact). On the one point

with a resharpened tip impact, the user originally attempted to apply a left bevel but extensive hinging out of the beveling flakes necessitated, in order to further resharpen the form, a switch to flake removals from the opposite face and thus, mainly a right alternate bevel.

At this juncture in the flow model, the SO 4 form can be reworked or damaged in several ways. The result is outputs SO 5 to SO 11 (see Figures 10, 11).

Serial Output #5 (SO 5; Figure 2d)

The points in this output are like SO 4 forms but they also possess probable functional modifications. Two have a small notch chipped into one lateral edge (e.g., Figure 2d-left). The remaining point. exhibits a blade/fore-section that runs off at an angle to a line drawn longitudinally through the medial axis of the base (Figure 2d-right). This outcome is due to the application of scraper retouch along only one lateral edge. The result is the recurvate lateral edge configuration on that one lateral edge and a form similar to the Albany "Beveled scraper", subtype II of Webb (1946:10-11), which also occur on Dalton points (Michie 1973:27) and Dalton-like points such as San Patrice of the lower Mississippi River area (Webb 1946:11-12).

Serial Output #6 (SO6; Figure 2e)

This output includes an SO 4 form exhibiting a subsequent tip impact from continued use as a projectile tip.

Serial Output #7 (SO7; Figure 2f)

Two long bladed points of SO 4 form that exhibit extensive tip impacts and breakage on one ear from previous use as weapon tips are included in this output. One point exhibits scraper retouch on one lateral edge while the other exhibits the same form of modification on both lateral edges. In both cases, this scraper retouch has been partially applied on top of the impact fractures near the tip indicating such scraper use post-dated the projectile use in these cases. One of the impact fractures (Figure 2f-left) extended slightly diagonally almost from the tip to the base and again suggests these points were launched with considerable force. Although these specific points are of a large size, apparently, the extensive reworking necessary to re-tip and re-base the points, and the extent of the general impact damage, would have resulted in too much of a size reduction making them unsuitable for continued use as projectile heads or other hafted tools. Therefore, they were simply converted to other “functiona1" forms and given their larger size were probably easier to use as hand-held tools such as side scrapers.

Serial Output #8 (SO8; Figure 2g)

This output includes three points similar to SO 4 forms except that they have very blunt tips and very short blades. These two attributes in combination are taken to indicate transverse snapping and the application of a new tip.

Serial Output #9 (SO9; Figure 3a)

The continued edge beveling of the short SO 8 form would result in the recurvate to almost straight lateral edges of these forms. Some of the points in this category are very similar to San-Patrice-hope or Hardaway-Dalton forms (i.e., compare Figure 3a with Coe [1964:64], Webb [1946:11] or Gardner [1974:44, Fig. 10]).

Table 6: Paradigmatic Classification/Table of Contrasts Showing Differences Among Outputs/Discarded Bifaces.

Output	N	Fore-Section Length	Reworking Mode	Shoulder Present?	Maximum Width Position	Lateral Edge Shape	Transverse Snap	Tip Form	Function/Use Change
DO 1	1	27	One Edge Bevel	Yes	At Shoulder	Excurvate, Recurvate	No	Blunt	Steep Bevel One Edge
SO 2	2	29+	One Edge Bevel	Yes	Above Shoulder	Excurvate	No	Impacted	None
SO 3 DO 3	2 5	30.5-44.0	Alternate Bevel	Yes	Above Shoulder	Excurvate	No	Pointed	None
SO 4 DO 4	3 3	36.0-46.0	Alternate Bevel	Little or None	At Shoulder	Excurvate, Recurvate	No	Pointed	None
SO 5	3	27.0-40.5	Alternate Bevel	Little or None	At Shoulder	Excurvate, Recurvate	No	Blunt to Pointed	Notches or Scraper Retouch
SO 6 DO 6	1 1	28+	Alternate Bevel	Little or None	At Shoulder	Excurvate	No	Impacted	None
SO 7	2	38+	Alternate Bevel	Little or None	Around Shoulder	Excurvate, Parallel	No	Impacted	Scraper Retouch
SO 8	4	24.5-27.0	Alternate Bevel	Little or None	At Shoulder	Excurvate	Yes	Blunt	None
SO 9	8	20.5-26.5	Alternate Bevel	None	At Shoulder	Straight, Recurvate	Yes	Blunt to Pointed	None
DO 10	1	Short (15)	Alternate Bevel	None	At Shoulder	Recurvate	Yes	N/A	End Scraper
SO 11	1	37.0	Alternate Bevel	None	At Shoulder	Recurvate	No	Blunt	None
SO 12	2	32.0-37.0	Alternate Bevel	Yes	At Shoulder	Recurvate	No	Pointed	None
SO 13	2	29.0-32.0	Alternate Bevel	Yes	At Shoulder	Straight	?	Pointed	None
SO 14	1	Long	None	N/A	Above Shoulder	Excurvate	Yes	Impacted	None
SO 15	1	N/A	N/A	Yes	Above Shoulder	N/A (Excurvate?)	Yes	N/A	N/A
SO 16	7	20.5-29.5	Alternate Bevel	Yes	At & Above Shoulder	Excurvate	Yes	Blunt	None

*: all Measurements are in mm

Table 6: Continued.

Output	N	Fore-Section Length	Reworking Mode	Shoulder Present?	Maximum Width Position	Lateral Edge Shape	Transverse Snap	Tip Form	Function/Use Change
SO 18	5	23.0-27.5	Bifacial-Symmetrical	Yes	At & Above Shoulder	Excurvate	Yes	Blunt	None
SO 19	1	27.0	Bifacial-Symmetrical	Yes	At Shoulder	Excurvate	Yes	N/A	Perforator
DO 20	1	31.0	N/A	Yes	At Shoulder	Excurvate	Yes	Pointed	Scraper Retouch
SO 21	1	35.0+	Bifacial-Symmetrical	Yes	Above Shoulder	Parallel	No	Impacted	None
SO 22	2	33.0-46.0	Bifacial-Symmetrical	Yes	Above Shoulder	Excurvate	No	Pointed	Spokeshaves, Perforator
SO 23	2	27.0	Bifacial-Symmetrical	Yes	At Shoulder	Excurvate, Straight	No	Pointed	None
SO 24 DO 24	2 1	31.5-38.0	Bifacial-Symmetrical	No	At & Above Shoulder	Excurvate	Yes	Pointed	None
DO 25	2	32.0-37.5	One Edge Bevel	No	At Shoulder	Excurvate to Recurvate	Yes	Blunt to Pointed	One Edge Bevel
DO 26	1	Long	Bifacial-Symmetrical	No	At Shoulder	Excurvate to Parallel	Yes	N/A	N/A
SO 27	1	N/A	Bifacial-Symmetrical	No	At Shoulder (?)	Parallel(?)	Yes	N/A	Use of Snap & Face Juncture in Plane-like manner
SO 28 DO 28	3 1	13.5-28.0	Bifacial-Symmetrical	No	At Shoulder	Excurvate, Recurvate	Yes	Blunt	None

Serial Output #11 (SO 11; Figure 3b)

The last output resulting from the reworking of SO 4 forms is represented by this category. Apparently, a point form similar to SO 4 was reworked by the addition of more lateral beveling resharpening to produce a long-bladed point with recurvate edges. This output is very similar to the "Advanced Stage" Dalton points of Goodyear (1974).

Pathway #2 (Figures 10, 12)

Points output from this pathway are characterized by an early life history of edge beveling on a long blade element. However, unlike the points in pathway # 1, such beveling did not involve the shoulder area.

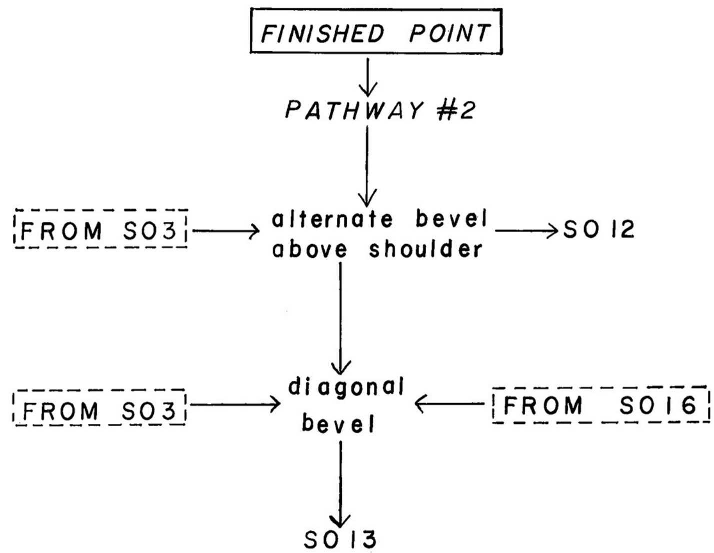

Figure 12: Segment of Flow Model Showing Hi-Lo Point Life Histories and Outputs in Pathway #2.

Serial Output #12 (SO 12; Figure 3c)

The two points in this category exhibit the unique combination of well-defined shoulders and recurvate lateral edges. It is probable that the shoulders were obscured by haft or binding or binding materials and therefore, could not reduced or removed by lateral resharpening.

Serial Output #13 (SO 13; Figure 3d)

These points exhibit short triangular blades with steeply beveled and relatively straight lateral fore-section edges. They could result from the diagonal beveling of SO 12 forms. Alternatively, they may be SO 3 or SO 16 outputs that have been diagonally resharpened to produce the straight edges. It is possible that the extensive diagonal reworking found on these points was purposefully applied to produce a pointed tip on a short-bladed point.

Pathway #3 (Fig. 10, 13)

The points in this pathway are characterized by transverse snap breakage early in their life history before the application of considerable lateral resharpening.

Serial Output #14 (SO 14; Figure 3e)

This output simply includes the blade element of an original form point prior to any reworking or resharpening.

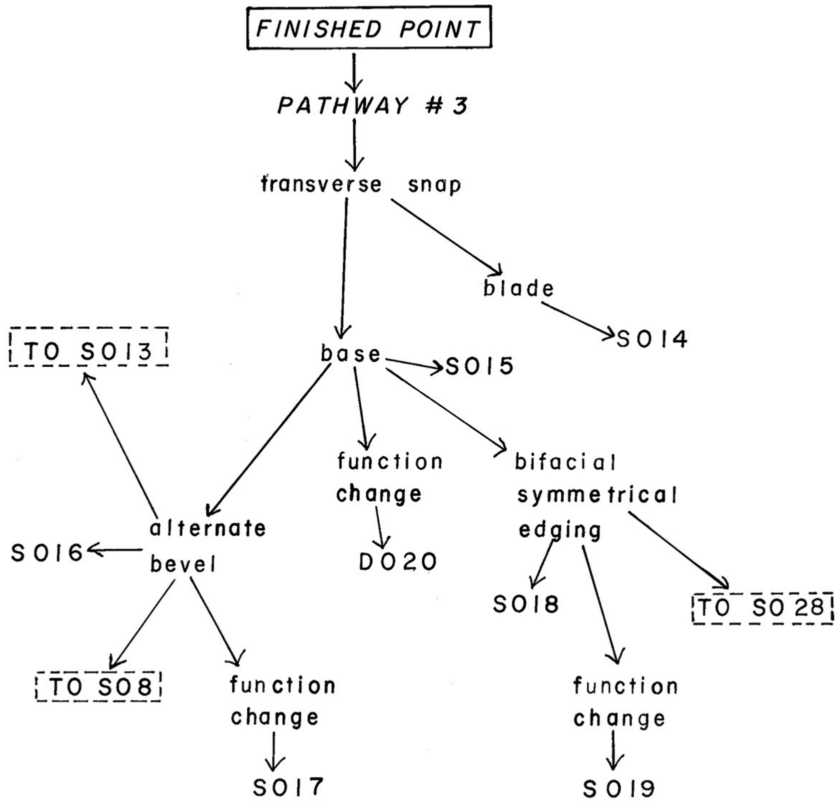

Figure 13: Segment of Flow Model Showing Hi-Lo Point Life Histories and Outputs in Pathway #3.

Serial Output #15 (SO 15; Figure 3f)

A base of an original form point prior to any reworking or resharpening is included in this category. At this juncture in the flow model, the SO 15 form could be re-edged to form short points with somewhat blunted tips as found in SO 16 through SO 18. The decision to re-edge was probably dependent on the length of the blade element remnant after transverse snapping.

Serial Output #16 (SO 16; Figure 3g)

These short-bladed points exhibit alternate bevels but still retain well-defined shoulders. The shoulders suggest that the points were not extensively laterally resharpened or were unresharpened prior to transverse snapping. Such an interpretation is also supported by a position of maximum width above the shoulder area on some points even though they have short blades. One point in this output still possesses part of an unreworked transverse snap near the tip. Points of an SO 16 form could be beveled again by retouch directed diagonally to the corner of the blade and steeply beveled forms with pointed tips (i.e., SO 13) would be produced. Alternatively, the SO 16 form could be continually beveled by removals directed more laterally than diagonally. The result would be shoulderless forms with recurvate edges such as those in output SO 8 of Pathway #1 (see Figures 10, 11 and 13).

Serial Output #17 (SO 17; Figure 3h)

One point identical to SO 16 forms has had a small “perforator"added to the centre of the tip indicating a change in its specific use.

Serial Output #18 (SO 18; Figure 3i)

These points are similar to those in output SO 16 but they have been re-edged by a bifacial-symmetrical edge retouch. Again, the presence of a well-defined shoulder and in some cases, a maximum width position above the shoulder, suggests they were not extensively laterally resharpened prior to transverse snapping. Continued bifacial-symmetrical edging would remove the shoulders and produce an output similar to points SO 28 in Pathway #4 (see Figures 10, 13 and 14).

<u>Serial Output #19 (SO 19)</u>: One point of an SO 18 form has had a small perforator added to the centre of a blunt tip indicating, as was the case with the SO 17 example, a change in how the item was specifically used.

Pathway #4 (Figures 10, 14)

The points in this pathway are characterized by extensive bifacial-symmetrical re-edging prior to transverse snapping.

<u>Serial Output #21 (SO 21; Figure 4a)</u>

This point is an original form which has been subjected to a selective bifacial-symmetrical retouch in the blade area from the shoulder to just above mid-point. The result is the parallel lateral edges. The point was then heavily tip-impacted

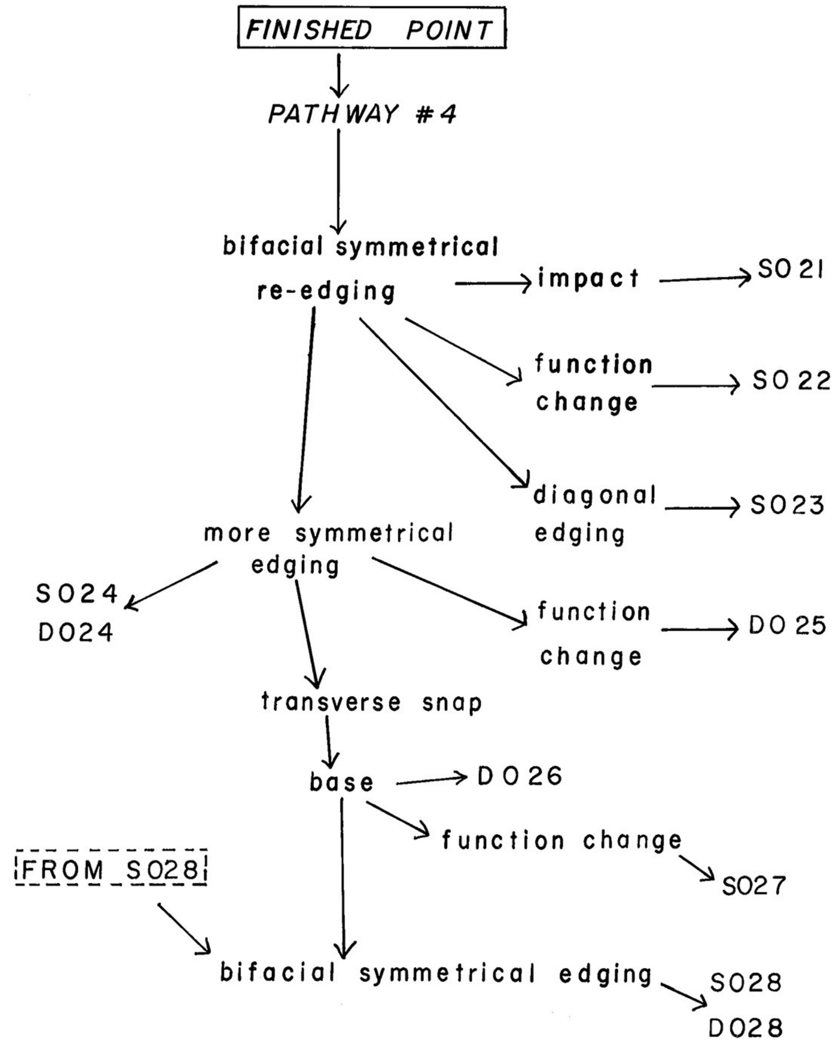

Figure 14:Segment of Flow Model Showing Hi-Lo Point Life Histories and Outputs in Pathway #4.

<u>Serial Output #22 (SO 22; Figure 4b)</u>

This output includes points which have been subjected to a small amount of bifacial-symmetrical re-edging prior to having edges modified to serve a different function or use. One point has a large, broad, well-chipped "spokeshave" concavity in one lateral edge. The other point has a small notch in one lateral edge and a partially broken "perforator"at the tip suggesting it may have been recycled into two other different uses. It is possible that this second point was converted to serve other uses because of the presence of what have been variously referred to as "hinge islands"or "pigs" or "step fracture plateaus" on one face (see Muto 1971; Whittaker 1994:166). These features are created when the knapper attempts to pick up hinge-outs from previous flake detachments from other edges or parts of the same edge. However, these other removals also hinged out. The result is a raised area/point of thickness surrounded by hinge fractures that cannot be removed.

Serial Output #23 (SO 23; Figure 4c)

This output includes two points with short, pointed blade elements and roughly straight to slightly excurvate lateral edges. They could result from continued diagonal edging above the shoulder area as applied to the original form or to SO 18 forms.

Serial Output #24 (SO 24; Figure 4d)

The points in SO 24 have somewhat long fore-sections, excurvate lateral edges and they lack bevels and well-defined shoulders. These attribute states could result from continued lateral resharpening but it is also possible that some of these items represent unshouldered Hi-Ho points.

Serial Output #24 (SO 24; Figure 4e)

One snapped base is included in this output. Lateral edge configuration suggests it is the snapped base of an SO 21 form. The thick right-angled snap fracture at the distal end has been subjected to multiple "blows" and exhibits extensive hinge fracturing on the face adjacent to the snapped end. This fracturing may be due to attempts to re-tip the point although, given its short blade length, this seems unlikely. It is more probable that such fracturing results from use of the thick edge as a hafted or unhafted planing tool on some resistant material (Ellis 2004a:62). Two other bases exhibit similar hinge fractures but they are too short to tell is they can be assigned to this specific output/life history (e.g. Ellis 2004a: Fig. 3.3a).

Serial Output #28 (SO 28; Figure 4f)

This last serial output category includes short-bladed, blunt points with recurvate lateral edges and no shoulders. These items could be transversely snapped and re-tipped SO 24 forms or, as mentioned above, they could be reworked short SO 18 forms from Pathway #3 (see Figures 10, 13 and 14).

DIRECT BLANK REDUCTION

Many of the reworked points produced originally by this reduction method are virtually identical in terms of specific post-manufacture life histories to those produced by serial biface reduction. They only differ in blank remnants that indicate manufacture on small thin flakes. Therefore, those with identical post-manufacturing life histories are not discussed below but are simply listed on the flow diagrams and on Table 6. However, in a few other output examples, there is variation in resharpening in some cases probably due to differing original thin flake blank characteristics that are retained on the finished forms -- these are discussed. Furthermore, there are some unique outputs resulting from direct reduction for which comparable serial output examples may exist in other collections.

Outputs

Direct Output #1 (DO 1; Figures 10, 11)

The one point in this category (Figure 4g) is similar to the original form except for a very steep unifacially chipped bevel on one edge. The result is one recurvate lateral edge. This particular reworking has been conditioned by the fact that the point was produced by direct blank reduction. Almost the whole interior surface of the point (opposite the face shown) is the unmodified ventral face of the flake blank and the point originally had a very plano-convex cross-section. In short, as a result of this cross-section to begin with there were steep almost beveled edges on both edges of one face on the same point. The extensive asymmetrical resharpening (i.e., it is confined to one

lateral edge) and the fact that the bevel was produced by a purely unifacial retouch, which rapidly results through reworking in a steep edge indicates that the user desired a steep working edge. It is suggested that the already steep edge of the unreworked point due to blank form was purposefully selected to produce such a working edge morphology. As with an earlier described serial biface output, the resulting point resembles the "Albany beveled scraper" of Webb (1946:10-11).

Direct Output #3 (DO 3; Figures 10, 11)

The points in this output (Figure 4h) are like those in SO 3; that is they are similar to the origina1 point form but possess an alternate bevel. However, two points (Figure 4h-left) are noticeably different from their SO 3 counterparts in that the blade goes off at an angle relative to the medial axis of the base. As with the previous direct blank form, it is suggested that such reworking was conditioned by the markedly plano-convex cross-section of the unreworked point but in this case, an acute-angled working edge was probably desired. The already somewhat steeper edge due to this cross-section was resharpened less than the alternate edge where flakes were removed from the underside of the steep unreworked edge. An acute edge bevel could be maintained longer by the underside removals and thus, more of the edge was removed by reworking and overall, the blade appears to run off at an angle versus the orientation of the base.

Direct Output #4 (DO 4; Figure 11)

These points (Figure 4i) are identical to SO 4 forms but they are not all isolated surface finds and so, can not as easily be construed to have been lost rather than discarded. One of the points (Figure 4i-left) has a steep unifacial bevel on alternate edges. Again, perhaps the plano-convex cross-section may have helped to determine this form of edge retouch.

Direct Output #10 (DO 10; Figure 11)

One point resembling SO 9 forms has been reworked into an end scraper (Figure 4j) and it was presumably hafted when used in that state.

Direct Output #20 (DO 20; Figure 13)

One item with a short blade and a blunt tip resembles a reworked SO 15 base. However, along both lateral edges on the same face, a scraper retouch has been applied which has removed most of the shoulders resulting in a "double side scraper".

Direct Output #25 (DO 25; Figure 14)

These two points (Figure 4k) are similar to the DO 1 form that was heavily reworked along one lateral edge to form a steep recurvate margin and has a fore-section that goes off at an angle relative to the medial axis of the haft element. In one case, the steep edge was achieved by a unifacial retouch. This point also exhibits a possible "perforator" at the tip (Figure 4k-right). As with DO 1 forms it is suggested that the knapper took advantage of the already steep edges on the convex face to produce a steep working edge and points resembling "Albany, subtype II, beveled scrapers" (Webb 1946:10-11).

Direct Output #26 (DO 26; Figure 14)

This output, which does not have a serial biface counterpart, includes simply two long bases which were laterally resharpened by a bifacial-symmetrical retouch to remove most of the shoulder prior

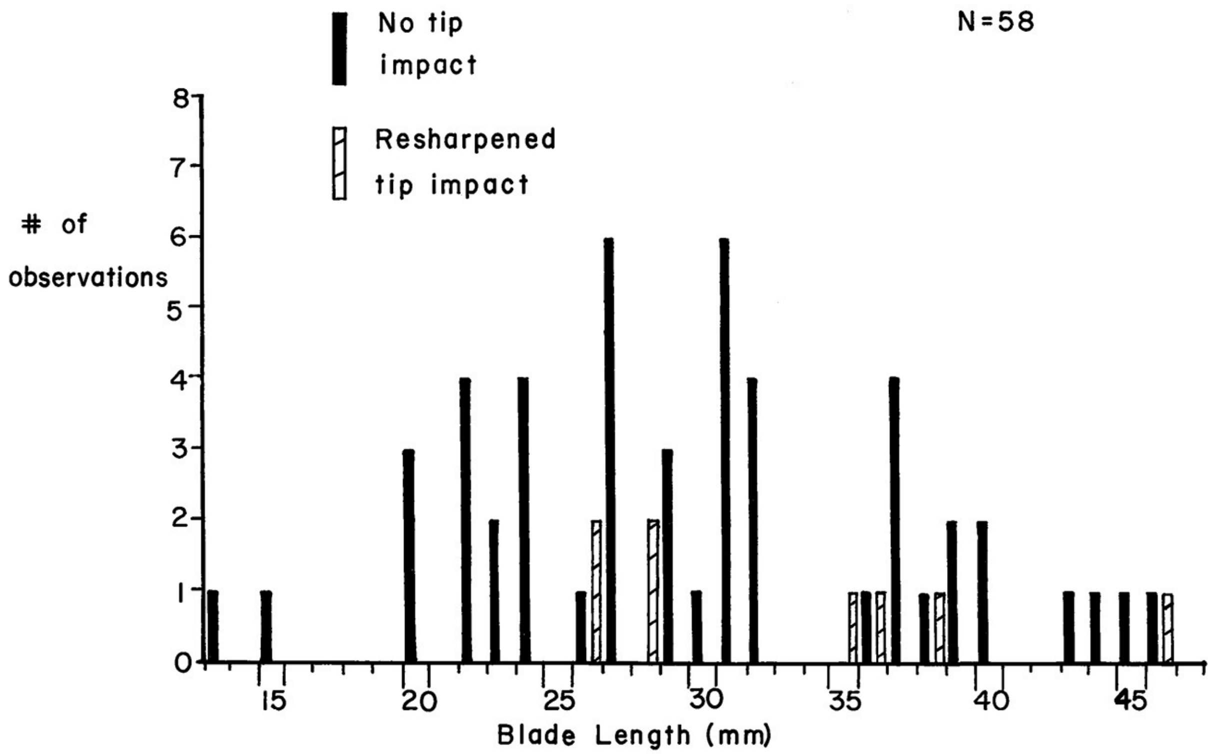

Figure 15: Incidence of Tip Impacts by Fore-Section (Blade) Length.

to transverse snapping (Figure 4l). Both of these points have long blade elements. They were probably not re-tipped because of ear breakage and pseudo-lateral burin blow at the base as well as the transverse snaps.

DISCUSSION

A) Tool Use

As noted earlier, accurate determination of the specific uses to which Hi-Lo points were put necessitates extensive microscopic examination, experimental replication and use. Nevertheless, the present analysis allows for some postulates regarding use that may aid as a guide to future research. First, the extensive impact fractures found on several of the points leaves little doubt that these points were used as projectiles. We would suggest also, given the extreme thickness of Hi-Lo points (see Table 4) that transverse snaps are largely a result of projectile use. Significant in this respect is one blade element (Figure 3e) exhibiting a transverse snap and tip impact.

The use of Hi-Lo points for other purposes is also indicated, not only by functional modifications into end scrapers, perforators, notches, “drills” side scrapers and spokeshaves but also by strong evidence for their extensive use as cutting tools including: 1) the emphasis on resharpening of the lateral point edges so that if carried far enough, recurvate edges can be eventually produced ; 2) those points that suggest that certain lateral edge angles of a generally acute or alternatively steep nature were desired or purposefully achieved (see below); 3) extreme lateral edge dulling on many points in the sample; and 4) by the extremely blunt ends characteristic of many short points. These blunt ends are usually suggested to be of little use as projectile tips (e.g., Springer et al. 1978; Goodyear

1974), an assertion which has been well demonstrated in the context of hunting certain types of larger game (e.g., Akerman 1978; Frison 1978:337-338).

There is also some suggestion of changes in function through a particular points use-life. Of course, the addition of functional edge modifications like scraper edges to tip impacted projectile points is one good example. However, it can be suggested also that there is a change in function with regard to projectile use. While not all short presumably more reworked forms exhibit blunt tips, such tips are restricted to the shorter points in the assemblage as outlined earlier and this might suggest a change from projectile to non-projectile emphasis in conjunction with blade length reduction. It is possible to test this hypothesis by examining the distribution of tip impacts by blade length. As shown on Figure 15, resharpened tip impact scars seem to be restricted to points over 26 mm in length although the available sample is perhaps too small to provide a meaningful analysis. It should be noted though that these resharpened points were longer prior to reworking, so 26 mm is a minimal estimate of length. Furthermore, Table 7 presents data on points with unreworked impact scars. With one exception, all of these points have blade elements over 28 mm in length. In the one case, where the blade element is only 18+ mm long, the extensive impact scars at the tip prohibit accurate length determination but it was apparently much longer prior to impact.

B) Factors Governing Reworking

Ultimately, all points were reworked due to edge dulling, breakage in use and other functional needs. In this section, we summarize and discuss why a point would be reworked in a particular manner or what factors determined the form of specific reworking.

1) Hafting

Hafting seems to have played a significant role in determining particular reworking modes. As previously noted, the thick blade elements would necessitate additional facial thinning to allow proper insertion of reduced basal elements (due to breakage and reworking) in the haft. Also, it was suggested that points with well-defined shoulders and yet, recurvate blade edges suggesting lateral resharpening had been carried out (SO 12), probably result from the shoulders being obscured by the haft and/or binding material. Indeed, the total occurence of recurvate edges is an attempt to maintain a desired haft element configuration while continuing to laterally resharpen the blade element and suggest that such reworking was carried out while the point was still in the haft.

Some investigators have suggested that an alternate bevel results solely from resharpening in the haft (cf. Wormington 1957 – for other explanations, see Lipo et al. 2012). In short, the hafted point is held in one hand, flakes are detached from the underside of the nearest edge and then the point is simply rotated laterally and flakes are removed from what was originally the opposite face on the opposite edge. If this is the case in Hi-Lo, and given that the bevel is achieved bifacially, then the flakes may be removed from the unbeveled face by "flicking" up the flaker during the removal of beveling flakes from the opposite face of the same edge. Alternatively, flakes may have been removed periodically from the unbeveled face by normal methods of flake removal.

2) Desired Edge Angle

Wilmsen (1970), in discussing unifacial tools, has suggested that certain edge angles may be desired for functional reasons. Although this claim has been disputed in certain contexts (i.e., Hayden 1979:61; Seeman et al. 2013:426), there is ample evidence in the present study that certain general classes of edge angles were desired *by their makers* in reworking the bifaces, presumably to meet what they perceived as key use demands. This desire has, in turn, determined the application of

certain reworking methods. As examples, first, a bifacial bevel rather than a truly unifacial one, would help to maintain more acute edges since continued unifacial beveling results in progressively steeper edge angles (Goodyear 1974; Sollberger 1971)[1]. Second, the long beveling flakes on Hi-Lo points, which approach or exceed the mid-line of the tool can be taken as a deliberate attempt to maintain more acute edges. As Sollberger (1971) has noted, on thick bifaces with marked convex faces, the removal of longer flakes rather than short ones allows one to maintain more acute edges through several re-edgings. This factor would also partially account for the tendency to abandon points on which unintentional, short, hinged-out flakes were removed. Third, in the present sample, only three points have unifacial bevels. In two cases (DO 1 and DO 25) these examples occur on points that have been very heavily resharpened on one lateral edge but not the other. The result is forms resembling "Albany beveled scrapers". These points indicate a purposeful application of a unifacial retouch to produce a steep edge. Fourth, there are forms in DO 3 which differ from their SO 3 counterparts in having "off-angled" blade/fore-section elements. As suggested above, these are interpreted to indicate more extensive lateral resharpening on that lateral edge where a more acute angle could be more easily maintained.

<u>3) Edge Form Prior to Reworking</u>

The edge form prior to reworking can partially determine the application of certain resharpening forms. For example, scraper retouch is consistently applied to what were previously thin, acute edges.

<u>4) Hinging Flakes</u>

The hinging out of flake removals can result in changes in reworking (as represented by one point in SO 4 which appears to have been initially beveled on the left and then, due to extensive hinge fractures along one lateral edge, was primarily beveled on the right) or changes in function (as in the SO 22 form with a hinge island that was converted to a notch and perforator).

<u>5) Blank Form and Manufacturing Procedure</u>

Blank form can have an effect on reworking methods. This factor is especially relevant in the case of marked plano-convex cross-sections that more closely approximate the original flake blank cross-section on points produced by direct thin flake reduction. The best examples are outputs DO 1 and DO 25 which resemble Albany beveled scrapers. In these cases, the user took advantage of an already steep edge on the convex face to produce a steep "scraping" edge.

<u>6) Extent of Use Damage</u>

This role of this factor is best illustrated by the two points output in SO 7. Both points have extensive impacts and ear snaps. Although the resulting damaged points both had long blade elements, the extensive reworking necessary to re-base and re-tip the points would have resulted in a large size reduction and a minimal use-life of the shortened form. Consequently, given their larger size and presumed suitability for gripping them in a hand-held tasks, both points were reworked by the application of scraper retouch to lateral edges, presumably to use them for other functions.

<u>7) Desired Tip Shape</u>

Certain outputs suggest that the desire for a certain tip shape can condition the method of reworking., For example, several of the shorter points (i.e., SO 13 and SO 23) have the sharpest tips in the sample. These were achieved by extensive diagonal re-edging to produce triangular-bladed, straight -

edged points and were presumably needed to maintain a sharp tip suitable as a projectile armature on a short fore-section.

8) Situational Criteria

This factor is dependent upon the immediate context of use (i.e., a particular situation), which results in spontaneous decisions to employ certain reworking options. The plano-convex cross-sections produced by direct blank reduction is one good example. In some situations, the user took advantage of an already somewhat steep edge to produce Albany beveled scrapers while in other cases such as the two points with off-angled blades in DO 3, the situation apparently demanded a more acute working edge. Therefore, more edge was removed by resharpening from the side where such an angle could be more easily maintained.

C) Factors Governing Output/Discard

These factors are very similar to those governing specific reworking methods. For example, hinge fracturing has been suggested as a reason for the discard of one of the points in SO 3. Also, extent of use damage is important. For instance, all of the bases created by transverse snaps, excluding cases where there is also ear breakage or pseudo-burin blows down a lateral edge, have blades with a minimum length less than 5 mm. These blades are too short to re-tip. Situational criteria are probably also important in determining discard.

Two factors which govern solely output include: 1) simple loss, as perhaps represented by all of the points in SO 4 which are long, undamaged and isolated surface finds (Figure 2c) and 2), extent of size reduction. Several points have been reworked until their fore-sections were too short to allow easy continued reworking.

CONCLUSIONS

This study strongly suggests that Hi-Lo points are subject to a complex life history, which induces considerable variability in the morphology of Hi-Lo bifaces output or discarded into the archaeological record. As previously noted, some of the complexity of the proposed model is due to problems in understanding the early life history of heavily reworked points. However, given the simplifying assumptions of this model, such complexity is probably a predominant characteristic of these histories. Certainly, Hi-Lo points seem to be subject to more complex reworking than that suggested for Dalton as presented by Morse (1971) and Goodyear (1974). Part of this complexity difference may be due to differences in the use of the tools. A more extreme emphasis on projectile usage may account for differences from Dalton in aspects such as: a lower frequency in Hi-Lo of edge beveling; a shorter blade element in Hi-Lo perhaps resulting from a higher incidence of tip fractures and transverse snapping; fewer recurvate (or incurvate) edges in Hi-Lo, especially on long-bladed points that indicates less emphasis on lateral resharpening; the Hi-Lo lack of serrations; and so on. Why such suggested use differences exist is something that needs to be examined in more detail in future studies.

As in Dalton, we have also shown that Hi-Lo points are often alternately beveled and in agreement with most Dalton researchers such as Goodyear (1974) and Morse (1971) we see this evidence as *prima facie* evidence that these points were used for tasks other than as simply projectile tips and notably as “cutting tools”. Some authors have continued to argue that such beveling in Dalton actually served to produce more accurate launched weapons by inducing spinning in flight and that these items unlike earlier fluted points were more unifunctional – that is they served largely as projectile tips (e.g. Lipo et al. 2012). Whatever the case in Dalton *per se*, in the Hi-Lo case there are

strong reasons to doubt the veracity of the ballistics explanation. While there is no doubt beveled Hi-Lo points could be and were used as projectiles, the beveling is frequently more pronounced on one lateral edge than the other or even completely restricted to one edge. Moreover, even on some items beveled on both edges often the resulting edge shape can be different with a more recurvate edges on one margin and a straight edge on the other. Even though impacts indicate they were clearly used as projectile tips, such asymmetry would seemingly overcome any advantages of beveling in using these items as weapon armatures. Moreover, many other heavily beveled Hi-Lo items have short fore-section with blunt tips that render them very unsuitable as projectile tips. Finally, the reworking of some edges notably on points made by direct thin flake manufacture indicate specific attempts to maintain certain more acute ranges of edge angles during beveling. This characteristic also suggests use of the edge is more important than any employment of edge beveling to effect the spin and accuracy of the items during weapon tip use.

As for characteristics that help to distinguish Hi-Lo points from other early point forms in the lower Great Lakes area, such as fluted or Holcombe (Wahla and DeVisscher 1969) points, it is clear, granted the formal variation due to life histories, that a polythetic type characterization (e.g. one in which all items assigned to the type have a high percentage, but not necessarily all, of a longer list of characteristics; see Clarke 1968) is necessary. Attributes of some use in such a type concept as indicated by the present analysis include: especially thick point blades, very blunt tips, edge beveling, distinct lateral basal thinning from one edge, large thick ears/basal corners, asymmetrically-shaped ears, the presence of shoulders or stems, incurvate to slightly notched basal side edges, a marked plano-convex cross-section, pronounced longitudinal curvature, large surface areas covered by original flake blank remnants, and, by contrasting available site collections, a higher percentage of "complete" points on sites.

Given that fluted and Holcombe points precede Hi-Lo in the central Great Lakes sequence, differences in Hi-Lo characteristics may suggest a drastic diachronic change in use patterns. A greater emphasis on non-projectile usage in Hi-Lo is strongly suggested by: the emphasis on lateral resharpening, which is almost unknown on fluted point or Holcombe sites in the lower Great Lakes; the higher percentage of complete points on Hi-Lo sites as opposed to these earlier sites such as Parkhill (Roosa 1977; Roosa and Ellis 2000) or Holcombe (Fitting et. al. 1966) where the point collections include almost all bases (the blades of which were not recovered); the blunt tips frequently found on Hi-Los versus the uniformly pointed ones on the earlier forms; larger, thicker, wider ears on Hi-Lo points which would resist breakage from movements associated with lateral edge use such as side to side movements against the haft; and the sheer frequency of Hi-Lo bifaces versus earlier ones that one could attribute to use in a wider range of tasks and a demand for more individual tools. The possibilities of this change in use for the appearance of notched points, or better anchors between the shaft and tool component (see Ellis 2004a:72-76; Jennings 2010; Springer et al. 1978), is one implication which deserves further testing and elaboration. At the very least, the recognition that Hi-Lo points were used much differently than their predecessor points suggests the major differences between them and the earlier forms need not indicate a lack of continuity but simply changes in how the tools were used and perhaps in how these peoples made a living.

Acknowledgments. The original draft of this paper was written over 30 years ago and it was circulated by us and actually cited by some scholars at that time. Ellis even delivered an earlier version of the paper at the 14th Annual Meeting of the Canadian Archaeological Association in Edmonton, Alberta in 1981. However, we still believe it makes some germane points and of course, we have updated this version somewhat for presentation here to take into account more recent published work on Hi-Lo and related point forms such as Dalton. Ed Eastaugh and Rick Cornwall have our sincere thanks for transforming our original 1980s photo negatives to a digital form useful for this published version. Funding for surface collection, excavation and analysis on Hi-Lo sites was

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Notes:

[1] Parenthetically, this might account for the fact that true unifacial bevels are applied on points with serrations such as in Dalton while bifacial bevels are applied to Dalton-like points lacking serrations such as in Hi-Lo and San Patrice-hope (Duffield 1963). Briefly, the presence of a cutting edge in Dalton is dependent not only on edge angle but also, on serrations. No matter how steep the edge, the serrations will provide a good "cutting" surface. Of course, Meserve points (Davis 1953) generally lack serrations and have unifacial bevels. However, most Meserve points of which we are aware are heavily laterally resharpened and have steep bevels (see Bell 1958: 52) so they equate with Goodyear's (1974) "advance stage" Dalton. As such, they resemble Albany beveled scrapers except that they have two steep working edges. In short, we would argue that Meserve knappers for the most part, purposefully desired steep working edges.

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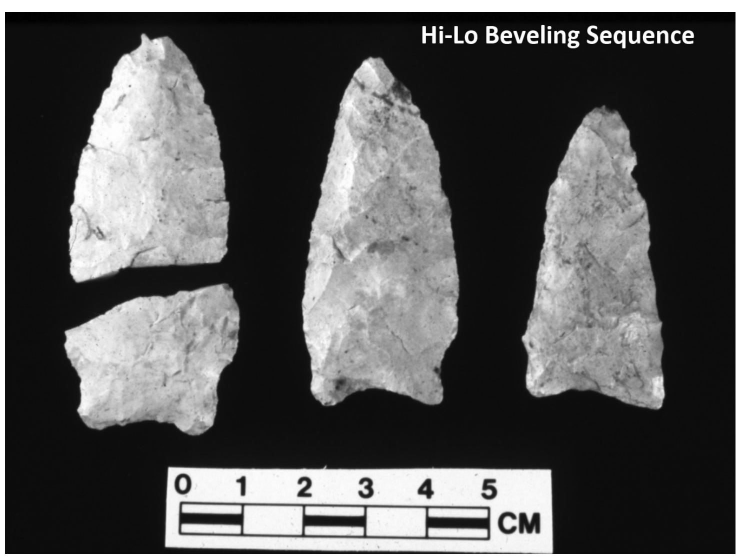

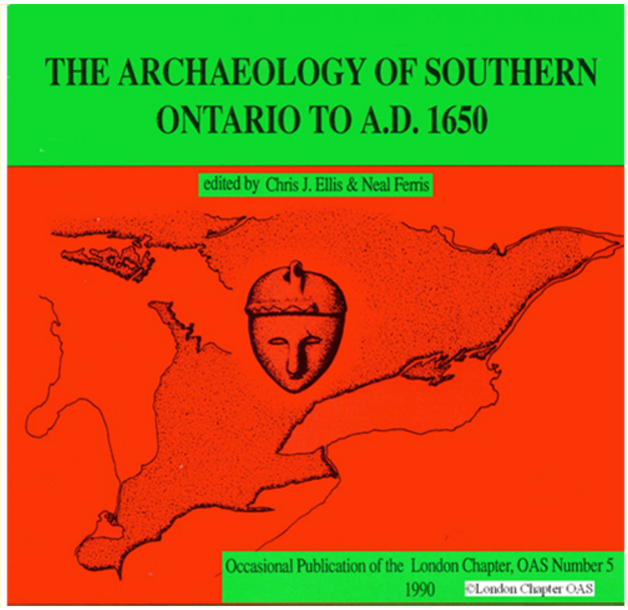

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